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ASTROPHYSICAL WORK

BY

J. S. PLASKETT, B.A.

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APPENDIX 2.

ASTROPHYSICAL WORK BY J. S. PLASKETT, B.A.

OTTAWA, March 31, 1909.

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Chief Astronomer,
Department of the Interior,
Ottawa.

SIR,—I have the honour to submit the following report upon the work carried on in the Astrophysical Department and in the other departments of the work of the Observatory under my direction during the past year.

It gives me pleasure to report satisfactory progress in all lines and to state that the work accomplished both in quality and quantity shows gratifying improvement over the records of previous years. As in previous years also it has been found necessary to spend considerable time in preparatory work, in testing, adjusting, and perfecting the instruments and appliances used, and in experimenting to determine the best methods of procedure. Although the time spent on such work necessarily diminishes the quantity of routine work accomplished, it is in my opinion time well spent, if through such investigations and experiments we are in a position to do a larger quantity of more accurate work. Consequently, much of my time during the past year has been devoted to investigations bearing on improvements in instruments and methods, of which full details will be given later.

It gives me much pleasure to be able to speak in the highest terms of the very satisfactory work done by my assistants, Messrs. Harper, Motherwell, DeLury, Cannon and Parker.

As heretofore, the principal work has been the determination of the radial velocities of stars by means of the spectroscope, and in this work observations have been chiefly confined to known spectroscopic binaries for the determination of the elements of their orbits. However, observations on some stars with early type spectra have also been secured during times when sufficient binaries have not been available, and in measuring up the plates we have found the velocities of four of these stars to be variable; δ Herculis, γ Aquarii, ι Andromedæ, ξ Persei. The two latter, it has since been learned, had been previousy found variable at the Yerkes Observatory, but not published, so that our discovery was independent.

The elements of the orbits of five spectroscopic binaries have been obtained, least squares corrections being applied in every case. The stars are θ Aquilæ, α Coronæ Borealis, η Boötis, ϵ Herculis, β Orionis. These stars will be discussed in detail below, but it may be of interest to mention that only in one case, η Boötis, have the observations been entirely satisfied by velocity curves due to simple elliptic orbits. In θ Aquilæ and ϵ Herculis a secondary disturbance due possibly to a third body, has been present. In α Coronæ Borealis the elements deduced from the hydrogen lines and the calcium, *K*, line differ from those obtained from the magnesium $\lambda 4481{\cdot}4$, while in β Orionis the amplitude of the velocity seems to be variable. This latter is of especial interest on account of the measures made at Yerkes and Lick Observatories showing its velocity to be constant within the apparent errors of observation.

Besides the binaries above, whose orbits have been determined, there are twelve others under observation, on three or four of which the work is well advanced. On the remainder, however, a considerable number of observations are still required. About 90 per cent of the binaries observed here are stars of early type, in the majority of which the lines in the spectra are broad and diffuse, in some cases unsymmetrically so, and consequently difficult of measurement. In such cases the agreement among the lines in a plate is poor and the error of measurement is high, the probable errors of single plates being as great as 7km. per second in some cases. It is evident that, unless there is a large range of velocity, the elements of the orbits of such stars are subject to considerable uncertainty, and indeed in several cases the star has had to be abandoned on this account after considerable work had been done on it.

The instrumental equipment for this work has been increased since my last report by the addition of a new single-prism spectrograph designed by myself, and constructed, except the optical parts, entirely in our own workshop. Owing to press of repair and other work it was not completed and put into commission until about the first of March, but it has fulfilled all expectations both as regards shortening of exposure time and in respect to its stability and freedom from flexure. The displacement of the spectrum lines produced by a revolution of 180°, this producing the maximum amount of flexure, is quite unmeasurable and is not even certainly visible under high power magnification; there is no question but that it is the most stable single-prism spectograph ever constructed. The difference between it and the previous instrument, which was for its type a rigid example, is very marked, the displacement in the early instrument being equivalent to a velocity of over 100km. per second.

My investigation on the fields given by different types of camera objectives for spectrographs was completed, and a concise account of the performance of all the objectives tested will be given below and will also appear in the Astrophysical Journal in May. Since my previous report a new single material Brashear objective for the new single prism spectrograph has been received and tested. Its angular aperture is about 50 per cent greater than the original one and when received, owing to the greater difficulty in correction, it had a small amount of positive aberration. By the kindness and through the skill of Mr. McDowell this aberration was finally removed and the objective is now practically perfect for its purpose. A special short focus objective by Ross has also been received and tested, giving beautiful definition and a fairly flat field. Thus, the requirements for all types of camera objectives have been successfully met, and there are now available suitable objectives for all classes of radial velocity and other spectroscopic work.

The investigation on the effect of increasing the slit width on the errors of measurement in radial velocity work has been continued with the two different dispersions now available. The new single-prism spectrograph and a short focus objective with the three prism instrument have been tested, giving results that bear out and extend those previously obtained. It is shown that, so far as early type spectra are concerned, both accidental and systematic errors approach a minimum value for a slit 0·051mm. wide and that the use of a narrower slit, instead of increasing the accuracy as has generally been supposed, has to a certain degree the opposite effect, to say nothing of the proportional increase of exposure required. A detailed report of this work will be postponed to allow it to be finally completed.

In presenting the work on radial velocities and allied investigations in detail, I have adopted the same plan as last year, of having each observer give the details and results of the work he has been engaged on. Consequently, below will be found, besides my own remarks on radial velocities in general, my description of the new spectrograph, the investigations on camera objectives and on the effect of slit width, and the orbit of β Orionis, the orbits of θ Aquilæ, η Boötis and ϵ Herculis by Mr. Harper, and the orbit of a Coronæ Borealis by Mr. Cannon. Mr. Parker, the third observer in radial velocity work, besides measuring many miscellaneous plates, spent

a great deal of time on the binary τ Tauri, but owing to difficulties due to causes outlined above was unable to obtain a satisfactory orbit and further observations next season will probably be necessary.

Work with the coelostat telescope in spectroscopic investigations of the sun has made satisfactory progress, although not as much has been accomplished as we had hoped. This has been due to various unavoidable constructional delays in having the 23-foot spectrograph and its attachments completed, to a long delay while the solar research laboratory was torn up for the installation of underground pipes and an electric pump for draining the transit house piers, and to a very thorough investigation of some peculiar properties in the plane grating used as the dispersion piece in the spectrograph. This investigation, which is fully described by Dr. DeLury below, showed that only by masking part of the grating could even fair definition be secured, while the best definition is necessary for accurate results in the determination of the solar rotation. A number of plates for this purpose have been secured and some preliminary measures by Dr. DeLury will be given. An illustrated description of the coelostat telescope and mechanism will be given by myself, and a description of the spectrograph and attachments by Dr. DeLury.

Mr. Motherwell has used the equatorial on three half nights per week in micrometric measures of double stars and has obtained a number of good measures, although his, as well as all other work with the telescope, has been much handicapped by the exceptionally poor observing weather of last fall and early winter. For nearly four months, smoke and cloud prevented almost all observations. This was especially unfortunate on account of the presence of Morehouse's comet, an especially interesting object, photographically, which this bad weather prevented from being photographed here more than half a dozen times. However, Mr. Motherwell will give an account in Appendix D of the double star measures obtained, of the occultations of stars by the moon observed, and of the photographs of the comet secured.

A full account of an interesting and useful investigation by Mr. Motherwell on the aberration of the 8″ Brashear Photographic Doublet, used in making the comet pictures, will be given. When this instrument was first tested by me, soon after the Observatory was completed, it was found to give halos around the stars of medium intensity, while in the brighter stars this halo had become so fully exposed as to make images of uniform intensity and of large diameter. This difficulty I ascribed to spherical aberration, but this diagnosis was opposed by the makers of the lens.

I suggested to Mr. Motherwell as a suitable and useful subject for investigation to determine by Hartmann's method of extra-focal exposures the amount of spherical aberration present. His thorough tests showed the lens to have negative aberration to the extent of about 3·5mm., which in our opinion was quite sufficient to account for the halo observed. A suggestion of Mr. McDowell that it was due to chromatic aberration was found by Mr. Motherwell not to be the case. The matter remained in abeyance for some time, when on a further suggestion from Prof. Hastings the separation of the elements of the front component was changed to remove the halo, supposedly a 'ghost' due to internal reflections. However, a test showed no improvement on the original positions in the slight change proposed. Further correspondence with Mr. McDowell resulted in a suggestion from him to increase the separation by about 2mm., which would practically remove the aberration. On this being done and the distance adjusted so that the aberration was removed, the halo disappeared which was a striking confirmation of our contention that it was caused by aberration. A recent letter from Mr. McDowell admits that we were right as he had proved by refiguring a lens giving a similar halo.

In consequence, the objective will be sent to Alleghney to have this aberration removed and with its already very flat field we should have an unequalled star camera. In this regard, I would urge upon you the desirability of supplying the camera with a separate mounting. Its attachment to the equatorial telescope results in seriously

limiting its usefulness; for when star photographs are being made, no work, other than the guiding, can be done with the equatorial. A separate mounting, however, would enable the two to be used independently and much more use could be made of the camera than is possible at present.

The quantity of repair and other work has increased so greatly, that the two mechanicians, Mr. Mackey and Mr. Lucas, the latter having been appointed since my last report, have not been able to keep up with all the work required. Repairs and minor alterations in the field instruments used in the Geodetic and Boundary Surveys, occupy about one-half their time, leaving the remainder for new work. The new single-prism spectrograph, the mechanical parts of the solar 23-foot focus spectrograph, and new hardened steel pivots on the meridian circle are the principal pieces of work accomplished. Besides these are numerous smaller pieces of work. Scarcely a day passes that some work does not come in.

The equipment of the machine shop has been increased by a 14 inch by 7 foot Hendry Norton lathe, which is installed and in use. With two lathes there is now no possibility of delaying work for lack of tools. The lathe is the tool most used in machine work and frequently cases occurred where both men required the lathe at the same time; in consequence the work could not be done to the best advantage. The workshop is too small for the tools and the amount of work done, and moreover the light in it is not of the best. It is desirable that, as soon as possible, provision be made for a suitable workshop above ground with ample room and light. The necessity and economy of a suitably equipped workshop for the Observatory are so evident, and the probability of an increase in its capacity being required is so great, as to justify the question of a more suitable location than the present one being carefully considered.

The field instruments and others of a portable nature have been most carefully looked after by Mr. Motherwell, who has kept a careful record of their movements. This work has become, with the increase in the staff and in the number of instruments, one of considerable labour and trouble and takes much of his time in the spring and fall.

The Saturday open nights of the telescope for the public continue to be well patronized, the average attendance on fine nights being upwards of fifty, and much intelligent interest is manifested by many of the visitors in astronomy. This interest is further fostered by the papers presented at the evening meetings of the Royal Astronomical Society of Canada, of which the majority are given by officers of the Observatory. It may not be amiss here to refer also to the value of the work done by the members of the Observatory staff in the afternoon or technical lectures given alternately with the evening ones. These lectures and papers presenting in most cases original work in different lines of astronomy have been of great value, not only in keeping us acquainted with each other's work but also in encouraging researches along original lines which have been frequently of distinct value to science.

The following papers by members of the staff of the Astrophysical Division have been published since the date of the last report:—

1. The spectroscopic Binary ι Orionis, by J. S. Plaskett and W. E. Harper, Astrophysical Journal XXVII., p. 272, May, 1908.

2. Effect of increasing the slit-width upon the accuracy of Radial Velocity Determinations, by J. S. Plaskett, Astrophysical Journal XXVIII., p. 259, Nov., 1908.

3. The spectroscopic Binary ψ Orionis, by J. S. Plaskett, Astrophysical Journal XXVIII., p. 266, November, 1908.

4. The Orbit of ι Orionis, by J. S. Plaskett, Astrophysical Journal XXVIII., p. 274, November, 1908.

5. The Astronomical and Astrophysical Society of America, by J. S. Plaskett, Journal of the Royal Astronomical Society of Canada II., p. 255, September-October, 1908.

6. The Reduction of Cadmium by Mercury and the Electro-Motive Force of Cadmium Amalgam, by R. E. DeLury and G. A. Hulett, Journal of the American Chemical Society, volume 30, No. 12, p. 1805, December, 1908.

7. Comet 1908 (Morehouse), by R. M. Motherwell, Journal of the Royal Astronomical Society of Canada III., p. 28, January-February, 1909.

8. The Orbit of θ Aquilæ, by W. E. Harper, Journal of the Royal Astronomical Society of Canada VII., p. 87, March-April, 1909.

Besides the above the following papers are to appear shortly, the work on them having been completed and sent to the publishers:—

9. Camera Objectives for Spectrographs, by J. S. Plaskett, Astrophysical Journal, May, 1909.

10. The Spectroscopic Binary β Orionis, by J. S. Plaskett, Astrophysical Journal, July, 1909.

11. The design of Spectrographs, by J. S. Plaskett, Journal of the Astronomical Society of Canada, May-June, 1909.

In addition to the above the Astrophysical Division have sent in the titles of the following seven papers to be read before the Royal Society of Canada at their meeting, May 25, 1909:—

12. A new Single Prism Spectrograph, by J. S. Plaskett.

13. Slit width and Errors of Measurement in Radial Velocity Determinations, by J. S. Plaskett.

14. The spectroscopic Binary β Orionis, by J. S. Plaskett.

15. The System of ϵ Herculis, by W. E. Harper.

16. Aberration of a Stellar Camera Objective, by R. M. Motherwell.

17. Convection and Stellar Variation, R. E. DeLury.

18. The Orbit of α Coronæ Borealis, by J. B. Cannon.

In general the work represented by these papers will appear in detail below, arranged sometimes in a little different form, and including as a rule the whole of the original measurements and data which were abbreviated or left out in the published papers.

THE SPECTROGRAPHS.

During the year just passed the Ottawa spectrograph, illustrated and described in the 1907 report, has been used almost entirely, the new single-prism spectrograph not having been ready for service until about March 1, 1909. The former instrument has been used mostly in the single-prism form, the three prisms having been used only for some plates of β Orionis and a few others. The spectrograph has not been changed in any way since the last report, and its performance has continued satisfactory. Nothing further need be added about this instrument, except that towards the close of the year the Zeiss Tessar objective of 300mm. focus, referred to in the last report, was temporarily mounted for the purpose of continuing the tests on the effect of slit-width on errors of setting so far as applies to a dispersion of three prisms with a short focus camera. This mount will be placed in a permanent form as soon as time can be found in the workshop, and used on solar type binaries too faint to be obtained with the long focus camera.

Before proceeding to describe the new single-prism spectrograph, which was briefly referred to in my last report, it has seemed desirable to enter more fully than was there done into the principles on which its design was based, and for this purpose I can not do better than give here a paper on 'The Design of Spectrographs,' which I read at an afternoon technical meeting on May 25, 1908, and which will appear in the May-June number of the Journal of the Royal Astronomical Society of Canada.

THE DESIGN OF SPECTROGRAPHS FOR RADIAL VELOCITY DETERMINATIONS.

Read before R.A.S.C., May 28, 1908.

'The subject of spectroscopy is so broad that one can not hope in a single paper to do more than touch upon a single aspect of it, and, even then, one must further limit his treatment to a particular application of this phase. Consequently, I propose to present some considerations bearing upon the design of spectrographs suitable for the accurate determination of stellar radial velocities. This branch of spectroscopy is comparatively new and is still probably only in the experimental and tentative stage. The present practice in this line has, however, reached a certain uniformity and the general theoretical principles governing the design of spectroscopes may be applied to the case under consideration, modified, of course, in many ways by the experience of the various observers. The question is one of a judicious combination of theory and experience, and I propose to present my own views, founded, of course, on theoretical considerations, but modified partly by the practice of other spectroscopists, partly by my own experience in the work and by the results of special investigations bearing on the most suitable form and dimensions of the instrument.

'The determination of the radial velocities of stars by means of the spectroscope is one of the most exacting of astronomical investigations, and requires the closest attention to all details to ensure accurate values. This will be more readily recognized when the smallness of the displacement of the spectral lines on which the velocity depends is known. Thus, in the Ottawa Spectrograph a velocity of 20km. per second, which is greater than the average velocity of the stars, causes a displacement at $H\gamma$, the centre of the measurable range, of about 1/2700 inch for the single-prism, and about 1/800 inch for the three-prism form of the instrument. The accidental errors arising in the measurement of this displacement, in spectra with good lines, are, however, not so much to be feared as systematic displacements of the lines as a whole, of which no evidence is given in the measurements, caused by flexure of the parts of the spectrograph, by temperature changes in the prisms and lenses and also in the metal frame, by faulty adjustment of the focal positions of camera and collimator, as well as by numerous other causes. Some idea of the magnitudes of these displacements may be gained from the following figures. An hour's exposure in one of the modern spectrographs introduces flexure displacement equivalent, in some positions of the telescope, to a velocity of 10km. per second. A change of temperature of 1°C. in the prism displaces the lines by about 20km., which may be increased further by the expansion of the metal parts. An inaccuracy in the focal setting of the camera of only 0·1 mm. 1/250 inch, may, when combined with poor guiding, cause a displacement of about 5km. It does not follow that such displacements necessarily cause a corresponding error in the velocity as they may be compensated for, partially at any rate, by a similar displacement of the comparison lines. But the possibility remains, and inaccurate results can only be prevented by constant and careful attention to all details. It becomes, therefore, a question of equally great importance with proportioning the optical parts to give accurately measurable spectra in the shortest possible exposure time, to so design the whole instrument that systematic errors due to the above or other causes may be provided for and eliminated as far as possible.

The design of a spectrograph may be most conveniently attacked under two separate headings:

1. The character and proportions of the optical parts.

2. The mechanical connection of these parts into a symmetrical and stable whole, with suitable auxiliary devices for controlling the temperature, applying comparison, &c.

The Optical Parts.

'Up to the present, prisms of dense flint glass have been the sole dispersing medium used for radial velocity work. Gratings, so useful in other branches of spectroscopy, have not yet been applied in this work, chiefly on account of the division of the incident pencil into a number of spectra with the consequent loss of light, and also on account of the difficulty of maintaining their position invariable without distorting the surface. Prisms have very decided advantages over gratings in this respect as, when set at minimum deviation, a small angular rotation of the prism will scarcely displace the spectrum lines, while with a grating the angular displacement of the lines is double that of the prism. The optical parts of a spectrograph are then:—1. The slit, whose width is usually between 0·025 and 0·051mm., one and two thousandths of an inch, on which the star image is condensed by the telescope. 2. The collimating lens placed at its focal distance from the slit and consequently rendering the incident pencil parallel. 3. The prism or prisms placed at minimum deviation for some particular wave-length usually near $H\gamma$. 4. The camera lens which forms an image of the spectrum on the photographic plate.

'As the terms dispersion, resolving power, purity, &c., will be frequently used and as the prism angle, thickness of base, &c., require computing, it seems preferable to give here a short synopsis of the theory involved and the formulæ used, particularly as these are not readily available in a suitable form or collected together in one place.

'When a pencil of parallel white light is incident upon a prism, the direction is changed, the light is deviated, and it is also decomposed into its constituent colours forming a spectrum, the wave-lengths of the light giving rise to these colour-sensations, diminishing as you go from red to violet. The fundamental formula determining the direction after refraction is, i being the angle of incidence, r of refraction,

$$\sin i = \mu \sin r.$$

μ is the index of refraction which varies for different materials and for different wave lengths in the same material, increasing as the wave length diminishes. In all spectroscopes the prisms are used at the position of minimum deviation, which, it may be easily shown, requires the angles of incidence and emergence to be equal. The discussion will therefore be confined to this particular case, resulting in a considerable simplification.

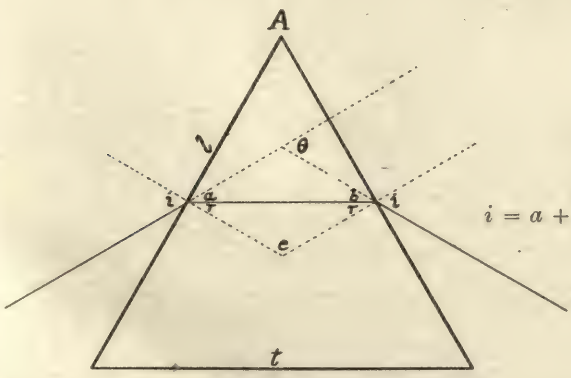

Fig. 1.

$$A + e = 180^\circ$$
$$e + 2r = 180^\circ$$
$$\therefore r = \frac{A}{2};$$
$$\theta = a + b; \quad a = b,$$
$$\therefore a = \frac{\theta}{2}.$$

$$i = a + r = \frac{A + \theta}{2}, \text{ and as } \sin i = \mu \sin r,$$

$$\mu = \frac{\sin \frac{A + \theta}{2}}{\sin \frac{A}{2}}.$$

If a is aperture of incident pencil just filling prism,

$$l = a \sec i.$$

$$t = 2\, l \sin \frac{A}{2} = 2\, a \sec\, i \sin \frac{A}{2}.$$

'If θ the deviation and μ the index are given to find A or the angle of the prism,

$$\sin\frac{A+\theta}{2} = \mu \sin\frac{A}{2} \text{ and reducing and simplifying}$$

$$A = 2\sin^{-1}\frac{\sin\frac{\theta}{2}}{\sqrt{\sin^2\frac{\theta}{2} + \left(\mu - \cos\frac{\theta}{2}\right)^2}}.$$

'The dispersion of a prism is usually defined as the ratio of the change in deviation to the change in wave length or $\frac{d\,\theta}{d\,\lambda}$. As the deviation varies with the index of refraction and as the latter varies with the wave length we may put

$$\frac{d\,\theta}{d\,\lambda} = \frac{d\,\theta}{d\,\mu}\cdot\frac{d\,\mu}{d\,\lambda}, \text{ but}$$

$$\mu = \frac{\sin\frac{A+\theta}{2}}{\sin\frac{A}{2}}$$

$$\therefore \frac{d\,\theta}{d\,\mu} = \frac{2\sin\frac{A}{2}}{\cos\frac{A+\theta}{2}} = \frac{2\sin\frac{A}{2}}{\cos i}$$

$$= \frac{2\sin\frac{A}{2}}{\sqrt{1-\sin^2 i}} = \frac{2\sin\frac{A}{2}}{\sqrt{1-\mu^2\sin^2\frac{A}{2}}},$$

$$\text{also } \frac{d\,\theta}{d\,\mu} = \frac{2\sin i}{\frac{\mu}{\cos i}} = \frac{2}{\mu}\tan i.$$

'To obtain $\frac{d\,\mu}{d\,\lambda}$ we require a relation between λ and μ. The simplest is obtained from Hartmann's interpolation formula.

$$\mu = \mu_0 + \frac{c}{\lambda - \lambda_0}$$

$$\therefore \frac{d\,\mu}{d\,\lambda} = -\frac{c}{(\lambda - \lambda_0)^2} \text{ and consequently}$$

$$\frac{d\,\theta}{d\,\lambda} = \frac{d\,\theta}{d\,\mu}\cdot\frac{d\,\mu}{d\,\lambda} = -\frac{c}{(\lambda-\lambda_0)^2}\cdot\frac{2\sin\frac{A}{2}}{\sqrt{1-\mu^2\sin^2\frac{A}{2}}}.$$

'Let us now consider resolving power or the ability of the prism to separate lines close together in the spectrum. Lord Rayleigh has shown, in the case of the image of

an infinitely narrow slit produced at the focus of a telescope lens, that the linear distance ξ of the first diffraction minimum from the principal maximum is given by the equation.

$$\frac{a\,\xi}{m\,\lambda\,f} = 1,$$

where a is the aperture and f the focus of the lens and m is a constant, 1·0 for rectangular and 1·2 for circular apertures.

$$\frac{\xi}{f} = \frac{m\,\lambda}{a}$$

$\frac{\xi}{f}$ is then the least angular distance at which two rays can be seen separated. Calling the angle $d\theta$ we have

$$d\,\theta = \frac{m\,\lambda}{a}.$$

For the case of a prism we have

$$a = l \cos i,\ t = 2\,l \sin\frac{A}{2}$$

$$\therefore\ \frac{t}{a} = \frac{2 \sin\frac{A}{2}}{\cos i} = \frac{d\,\theta}{d\,\mu}$$

Combining we get the minimum condition of resolution

$$t = \frac{m\,\lambda}{d\,\mu}.$$

Again, omitting the constant m, we have

$$d\,\theta = \frac{t\,d\,\mu}{a} = \frac{\lambda}{a},$$

and multiplying by $\frac{a}{d\,\lambda}$ we get

$$a\frac{d\,\theta}{d\,\lambda} = t\frac{d\,\mu}{d\,\lambda} = \frac{\lambda}{d\,\lambda}$$

where $\frac{\lambda}{d\lambda}$ is the minimum value which permits resolution of close lines. $\frac{\lambda}{d\lambda}$ or the ratio between the mean wave length of a pair of lines which can just be resolved in a spectroscope and the difference in wave length between the two components is called the resolving power of the spectroscope and is usually designated by the letter R.

'The linear dispersion $\frac{ds}{d\lambda}$ where f = focal length of camera is

$$\frac{d\,s}{d\,\lambda} = f\cdot\frac{d\,\theta}{d\,\lambda} = f\cdot\frac{R}{a}.$$

'The resolving power R refers to infinitely narrow lines through an infinitely narrow slit. When, as necessarily occurs in practice, neither of these two conditions holds, we speak of the purity of the spectrum or the practical resolving power for wide slits. Schuster has given a simple expression for the purity which is always a fraction of the theoretical resolving power R. This expression has been elaborated by Wadsworth.

and later still Schuster has given tables for determining the purity. But as no appreciable error will be introduced in the relative values used in this work, it has seemed preferable to adhere to the simple form. If d = slit width and ψ = angular aperture of the collimator $= \frac{a}{f}$, the Purity $P = \frac{\lambda}{d\,\psi + \lambda} \cdot R$.

'We have now obtained all the formulæ necessary to compute the data for any optical system and to compare the efficiency of different forms of spectroscopes. To take a concrete case, which is more applicable for our purpose than a general discussion, I propose to consider the question of the most suitable aperture to be given a single-prism spectrograph which is being constructed for the Dominion Observatory. The present spectrograph, which is arranged to be used with either one or three prisms, has a collimator of 35mm. aperture, 525mm. focus and two cameras, one for each form of 525mm. focus. It performs excellently for both purposes, but when, as often happens, both single and three prisms are required on the same night, the change from one form to the other is somewhat tedious, requiring 15 or 20 minutes, and moreover, what is far more important, such change involves uncertainties as to the temperature conditions of the optical parts and therefore corresponding uncertainties as to the accuracy of the velocities obtained.

'In order to fill the collimator lens completely with star light its aperture ratio $\frac{a}{f}$ must be the same as that of the equatorial. The aperture ratio of the Ottawa telescope is 1 to 15, consequently the focal length of the collimator must be 15 times the aperture. This aperture is limited on the lower side by the condition that sufficient purity must be obtained, purity being proportional to the aperture at a practicable width of slit, to so separate lines and blends of lines that sufficiently accurate identifications of lines and the true wave lengths of blends may be obtained. It is limited on the upper side by the difficulty of obtaining homogeneous prisms of large size, by the increased absorption of such prisms, and by the increased size and weight of the instrument. In all the spectrographs used in radial velocity work the apertures lie between 30 and 51mm., and these seem to be about the practical limits. It remains to determine the most suitable.

'The basis of the discussion* rests upon the results obtained for the effective diameter of the star image given in my paper on 'The Star Image in Spectroscopic Work,' No. II, which was read here last fall and published in the Astrophysical Journal, March, 1908. The results of a number of experiments, photographs of star images, spectra and trails, went to show that only very rarely is the effective diameter of the image less than 2 secs. of arc (about 0·055mm.) at the focus of the refractor. Generally the diameters of images and the widths of spectra and trails are considerably greater, increasing to over 0·1mm. with longer exposures. As the theoretical diameter of the central disc is only 0·57″ (about 0·015mm.) and, as the condensing system of visual objective and photographic correcting lens is practically perfect, the enlargement in diameter is undoubtedly due to atmospheric disturbances. These consist probably partly of a blurring or spreading out of the central disc and partly of small displacements in all directions from its mean position. In consequence there results considerable loss of light at the slit jaws with the widths usually employed, and further experiments showed that the proportion transmitted varied almost directly with the width until this reached 3 or 4 secs. I reproduce below part of the table for slit transmission given in the paper referred to:—

* An able discussion of this subject on somewhat similar lines, to which I am much indebted, has been given by Newall (M. N. 65, p. 608).

SLIT TRANSMISSION.

Slit Width.		Comparative exposure for equal intensity of spectrum.	
Linear mm.	Angular secs.	Observed.	Corrected for loss by diffraction.
0·025	0·91	100	100
0·051	1·82	40	50
0·076	2·73	27	35
0·102	3·64	25	32

'This table shows that if the slit width can be increased the exposure is proportionally diminished, double the slit width halve the exposure, which means, of course, an increase in the output and in the practical range of the equipment. But on the other hand, a widening of the slit, other conditions remaining unchanged, decreases the accuracy of measurement of the resulting spectra. This loss of accuracy is due to two causes: first, diminished purity rendering uncertain identifications and wave lengths of blends; second, increased diffuseness of the spectral lines rendering measurements more difficult. We will take up these two considerations separately and find under what conditions the slit may be widened without loss of accuracy.

'The equation for purity of spectrum, $P = \frac{\lambda}{d\psi + \lambda} \cdot R$, shows that the purity is almost proportionally diminished as the slit width is increased as $d\psi$ is, even for slit 0·025mm., nearly ten times λ. To increase the purity of a spectrum only two courses are open—to diminish the slit width or increase the resolving power. As we wish to widen the slit the resolving power of the spectroscope must be increased, which may be done in three ways.

1. By increasing the aperture of the prism or prisms $R = \frac{\lambda}{d\lambda} = a\frac{d\theta}{d\lambda}$ or R varies directly with the aperture.

2. By increasing the number of prisms.

3. By shifting the region of spectrum under observation towards the violet. The resolving power varies inversely as the cube or slightly higher power of the wave length. This will be seen directly when we compute resolving powers, but it follows at once by differentiating Cauchy's form of dispersion formula.

$$\mu = A + \frac{B}{\lambda^2} + \frac{C}{\lambda^4} + \dots \text{ or simply}$$

$$\mu = A + \frac{B}{\lambda^2}$$

$$\frac{d\mu}{d\lambda} = -\frac{2B}{\lambda^3}.$$

'The use of the second method increases the dispersion which is usually not allowable on account of the proportional increase of exposure time entailed. The third method can not be used with a refractor and glass prisms on account of the strong absorption of ultra violet light by the glass of the lenses and prisms. With a reflector and a quartz or ultra-violet glass spectrograph it might be applicable. We are therefore practically limited to the use of a larger prism and consequently larger collimator and camera lenses.

'The size of prisms in use in radial velocity work, as previously stated, lies between about 30 and 51mm. Prisms of 51mm. aperture are successfully used in the Yerkes Spectrograph, but Frost's experience as also that of Hale in large spectro-heliograph prisms shows that the limit is nearly reached.

'In discussing the necessary conditions for using a wider slit, let us take as an example a comparison between the efficiencies of single-prism spectrographs of 35mm., the aperture of the present instrument, and 51mm. aperture, the latter having been decided upon, after careful consideration, as the aperture of the new instrument. A spectrograph of such aperture, outside of considerations of the homogeneity of larger prisms, is the practical limit as regards size and weight that can be attached to a 15-inch equatorial.

'The glass generally used for the prisms is Jena glass 0·102, Dense Silicate Flint, and this was chosen for the spectrographs here. It is very colourless considering its density and dispersion. The indices of refraction of the particular melting from which the present prisms were made, as furnished by the makers, are as follows:—

Wave Length.	Index of Refraction.
·00006563 cm.	1·6413
.00005893 cm.	1·6467
.00004862 cm.	1·6603

'From these values substituted in the Hartmann formula $\mu = \mu_o + \frac{c}{\lambda - \lambda_o}$ we obtain the values of the three constants μ_o, c and λ_o.

$\lambda_o = \cdot 00002190.$

$\mu_o = 1\cdot 61146.$

$\log c = \bar{6}\cdot 115595.$

'From these constants were calculated for a number of wave lengths μ and $\frac{d\mu}{d\lambda}$. From $\frac{d\mu}{d\lambda}$, R was obtained for prisms of 35 and 51mm. aperture, and of refracting angle 63° 50′, this being the angle required to deviate the ray at minimum, λ 4415, 60°. The formulæ used were previously derived and are:

$$\frac{d\mu}{d\lambda} = -\frac{c}{(\lambda - \lambda_o)^2}.$$

$$R = t\frac{d\mu}{d\lambda} \text{ where } t = 2a \sec \frac{A + \theta}{2} \sin \frac{A}{2}.$$

Wave Length.	μ	$\frac{d\mu}{d\lambda}$	R Prism 35 mm.	R Prism 51 mm.
4862	1·6603	1829	14420	21010
4550	1·6667	2343	18470	26910
4415	1·6701	2636	20780	30280
4341	1·6721	2822	22250	32420
4102	1·6796	3490	27520	40100
4000	1·6833	3983	31400	45750
3970	1·6848	4119	32380	47180

'The resolving power for the two apertures obtained, the purity of spectrum for different slit widths is readily calculated from $P = \frac{\lambda}{d\,\psi + \lambda} \cdot R$, ψ in this case, being $1/15$ or ·0667. The results are given in the following table for the wave length 4341 or $H\gamma$, this being the usual central ray.

PURITY OF SPECTRUM.

Slit Width.	Prism 35 mm.	Prism 51 mm.
0·025	4596	6697
·040	3114	4537
·051	2518	3670
·063	2084	3036
·076	1755	2558

'These figures show that with the larger prism the slit may be made 50 per cent wider and still have practically the same purity of spectrum, and consequently the same accuracy of velocity determinations.

'The slit transmission table previously given showed that an increase in slit width of 50 per cent when below 0·076mm. increased the quantity of star light transmitted by nearly 50 per cent; consequently, other conditions being equal, half as many more spectra could be made in a given time. But an increase in the size of the prism means also an increase in the quantity of light absorbed by the glass of the prism, although the amount reflected will be the same. We can obtain an accurate knowledge of the quantity of light absorbed in the two prisms of O. 102 glass from Vogel's experiments (Astrophysical Journal, V., p. 75), who showed that $H\gamma$ light transmitted through 100mm. of O. 102 glass suffered absorption of about 47 per cent. The absorption for prisms of 35 and 51mm. aperture, average length of path 39 and 57mm. respectively, may be readily calculated by the formula $I_1 = I_0 K^{\frac{x}{a}}$, where x is thickness of glass for which absorption is required, a is thickness for which percentage transmitted is K, I_0 intensity of incident, I_1 of transmitted beam. We obtain for prism of 35mm. aperture 78 per cent, of 51mm. aperture 71 per cent transmission. If 100 be intensity of incident pencil for small prism, then 150 will be intensity of pencil giving equal purity with large prism. After transmission intensities will be 78 and 150 × ·71 or 106·5, respectively, and the required exposures will be inversely proportional or as 3 to 4, a very considerable gain. Even when the slight additional absorption in the thicker camera and collimator lenses is considered a substantial saving of time will result by the use of the larger prism.

'We have tacitly assumed in the foregoing discussion that a decrease of purity entails loss of accuracy in the velocity values. This is undoubtedly true for complex spectra such as those given by solar or allied type stars, spectra in which are hundreds of lines and in which every decrease in purity means increased uncertainty in the wave lengths of the more complex blends of lines thereby produced. In the case of early-type stars, however, such as those of the hydrogen or helium groups, where there are only few lines, and these single, there can be no trouble with blends, and the question of the purity of the spectrum has not so much weight. On such grounds there would be no material advantage in using the larger aperture. However, a consideration of the second effect produced by widening the slit—the increased diffuseness of the spectral lines—will show a similar advantage for the larger aperture even where purity does not come into question.

'This may be best shown, as before, by considering a special case and we may take the same example with advantage. The present single-prism spectrograph has a collimator objective of 35mm. aperture and 35 x 15 or 525mm. focus. The camera has a focus of 525mm., and therefore the image of the slit on the plate will be of the same size, and the minimum width of line will be the width of the slit. The new spectrograph will have a collimator of 51mm. aperture and 51 x 15 or 765mm. focus. The camera will be of about 455mm. focus. Hence the image of the slit on the plate will be diminished in the proportion of 455 to 765 or about 3/5. If the camera were of the same focus as the one now in use, 525mm., the image of the slit would be diminished to about 7/10. Hence the slit can be made in the one case 5/3, in the other 10/7, the width with the present spectrograph, and have the lines of the same width, and consequently equally accurately measurable. The gain in efficiency is thus about equal under the latter consideration and that of the maintenance of equal purity, and we may therefore consider that a decided advantage may be obtained in stars of all types by increasing the aperture of the prism. Such conclusions are, of course, subject always to the test of actual use under similar external conditions before they can be accepted as final.

'However, some experiments that I made here last winter on the effect of widening the slit upon the accuracy of velocity determinations* substantiate the above conclusion, and I will therefore give a short summary of some of the results reached. As previously stated, when the slit is widened, the purity is diminished and the lines become broader and more diffuse. To simplify the investigation, the question of the effect of purity was eliminated by choosing a star, β Orionis, for the test whose lines are single and moderately sharp. There remains, then, only the question of the effect of the increasing breadth and diffuseness of the lines on the accuracy of the measures. Evidently such a question can only be settled by making and measuring a number of spectra at each slit width. Six plates were made for each slit width 0·025, 0·038, 0·051, 0·076mm. for two dispersions, (*a*) single-prism 525mm. camera, (*b*) three-prism 525mm. camera and six each at slit widths 0·025, 0·051 and 0·076mm. for a dispersion of three prisms and camera of 275mm. focus. In all 66 plates were made, of which I have to thank Mr. Harper for measuring 18 and thus lightening the considerable labour involved. Owing to the different dispersions, different lines were measured in the three sets, but as the main dependence can be placed on the three lines *Mg* λ4481·400, *He* λ4471·676, $H\gamma$ 4340·634, the results from these three lines only are given. Computations using all the star lines measured were also performed without, however, changing the conclusions reached.

'There are evidently two kinds of error to be considered, accidental and systematic. Under the first will be considered the accidental errors of the setting of the microscope wire on the individual lines in a plate, resulting in a mean velocity for that plate differing from the true velocity in a greater or less degree depending upon the quality of the lines. The systematic error of a plate is the displacement of the star lines as a whole with respect to the comparison lines. This may be due, as previously stated, to one or more of several causes—change of temperature, flexure, faulty adjustment or aberrations in the optical train, &c. As the lines are in general equally affected, such displacement will not be apparent in the measure of a single plate. It is only by comparing the velocities of a number of plates of a star of constant velocity that such an error can be detected.

'To compare the accidental errors for the different slit widths it will be necessary, to prevent systematic displacements from affecting the result, to treat the measures for each of the six plates for one slit width separately, to obtain the residuals from the mean velocity of each plate and finally the probable error of measurement of an average star line from these residuals. Some idea of the relative magnitude of the sys-

* Since published in the Astrophysical Journal, Vol. XXVIII, p. 259.

tematic errors may be obtained by treating the velocities from each of the six plates. However, this result will not be that due to systematic error only, as the velocity from each plate will also be affected by accidental errors. The results of the measures and computations are given below:—

PROBABLE ERRORS.

Dispersion.	Slit Width.	Accidental Prob. Error, Average Line.	Systematic Prob. Error, Single Plate.
Single Prism	0·025	±4·5 km.	±1·7 km.
	·038	2·4	2·7
525 mm. Camera..................	·051	2·3	3·0
	·076	4·3	7·7
Three Prisms	0·025	±2·3	±1·5
	·038	2·1	1·3
525 mm. Camera.	·051	2·5	0·7
	·076	2·1	0·9
Three Prisms.	0·025	±2·9	±2·1
	·051	2·9	3·0
275 mm. Camera..................	·076	3·8	2·9

'These results were to a considerable extent unexpected. The great difference in the apparent quality for measurement of the spectra made with slit 0·025 and 0·076mm., especially with the single-prism, would lead one to expect a marked increase in the errors of setting, but this is not very distinctly shown, not at all in the higher dispersion. The systematic errors, however, are very markedly increased in single-prism plates, so much so as to prohibit the use of slits wider than 0·051mm. In a higher dispersion spectroscope this increase has disappeared, and, so far as the rather small number of plates shows, it is slightly more accurate in the case of dispersion (*b*) to use slits 0·051 and 0·076mm. than slits 0·025 and 0·038mm. It is evident that these results corroborate the conclusions previously reached, by showing that increase in resolving power removes or diminishes the loss of accuracy when the slit is widened. Consequently, with the 50 per cent greater resolving power and the 60 per cent greater ratio of collimator to camera focus, it is probable that the slit-width may be increased 50 per cent without affecting the accuracy of the results and with a corresponding increase in the output.

Mechanical Design.

'The question of the most favourable dimensions of the optical parts having been discussed, there remains the mechanical structure connecting these parts into one stable whole. Owing to the attachment of the instrument to a moving telescope and the consequent varying direction of gravity on the parts, the prevention of flexure is one of the most difficult of the problems to be overcome, and this is especially the case where the instrument is to be attached to a telescope of moderate size, where its weight can not exceed a certain small limit. The weight of our spectrograph complete with temperature case, attaching truss, &c., can not much exceed 100 lbs., and the problem is consequently a much more difficult one than in the case of the Yerkes equipment, for example, where the spectrograph weighs about 500 lbs. Most of the early and some of the recent spectrographs have lacked sufficient stiffness and stability to prevent line displacements due to flexure of the parts. A displacement of the camera and plate of only one one-thousandth of an inch is equivalent in a single-prism spectrograph to a velocity of about 50km. per second. It is evidently a difficult

matter in the extended form of a single-prism instrument to reduce this flexure to an inappreciable amount. No material is perfectly rigid and when we consider that even its own weight deforms the strongest material available, the difficulty of the problem will be realized.

'Until very recently all spectrographs were attached to and overhung the end plate of the telescope and thus, like a beam fixed at one end, were subjected to the maximum amount of flexure. An improvement in the principle of attachment was applied at the Lick Observatory recently, in which the spectrograph proper is made self-contained and is held in an independent cradle at two points of support. It is thus like a beam supported at both ends and the flexure is thereby much reduced.

'The original spectroscope belonging to the Observatory was by Brashear of an adjustable universal type and was not, for this very reason, suitable for radial velocity determinations. Braces were added to stiffen the frame as much as possible, but it could not be freed from flexure. Many of the results obtained were uncertain and its use was discontinued as soon as a new combined one and three-prism spectrograph, designed by myself and very satisfactorily constructed by Mr. Mackey in the Observatory workshop, was completed.

'This instrument, whose general form is readily obtained from the figures, page 78 in my report to the Chief Astronomer for 1906-7, has many original features, has given excellent satisfaction and produced reliable results. It is, as will be noticed, a form of the first class mentioned attached only to the end plate of the telescope. It was designed and partly constructed before anything was learned of the new type. Moreover it was desired for the sake of economy of time and money to combine single and three-prism instruments in one (since found by experience to be a mistake), and this could not be advantageously effected in the new form.

'The form of truss designed has some advantages over previous instruments, and has probably less flexure than any other of the same type and weight. The main difference lies in the close grouping of the triangular truss at the lower end and the addition of the substantial diagonal brace, which serves the two purposes of stiffening the outer end of the prism box and lower end of the camera when used in three-prism work, and of tying the outer end of the camera when used with a single prism. The maximum flexure of the three-prism instrument is equivalent to 1·8km. only, while the maximum flexure of the modern Bonn three-prism instrument, the only one for which data have been published, is about 70km. For an hour's exposure with the Bonn instrument there is a flexure of 7km., while a similar exposure with both single and three-prism forms here shows no appreciable flexure. The maximum flexure with our single prism is much greater, about 100km., equivalent to a linear displacement of about 1/400 inch. This great difference in the two forms is due to two causes. First, to the threefold greater kilometre value for the same linear displacement. Second, to the much more extended form of the single-prism instrument. Calculations have shown that the amount of flexure is nearly that caused by the actual extension and compression of the truss members due to their own weight, and consequently it can not be avoided or much reduced in this form of instrument. However, the flexure occurring during a two hour's exposure is only slight except at such great hour angles as are rarely used.

'Both forms of instrument are frequently required on the same night, for stars of varying brightness and type. The time lost in making the change from single to three prism or vice versa, and the uncertainty in the temperature conditions prevailing after the change, close temperature regulation being equally as important, perhaps more important than avoidance of moderate flexure, were considerations leading to the decision, which had the approval of Dr. King, to design and construct a separate single-prism spectrograph, with separate temperature control and attaching stand, so that the change could be made in a minute or two, and without disturbance of temperature.

'Besides using a larger prism for the reasons fully entered into above, the opportunity was taken of changing the mode of attachment to the telescope. Curtiss, of Ann Arbor, designed a form of single-prism instrument modelled after the Lick pattern, which has two points of support, one near the slit and the other near the base of the prism. The spectrograph proper consists of a triangular brass box with angles of about 120°, 30°, 30°. The prism is at the obtuse and the slit and camera at the acute angles of the triangle. The camera end hangs out unsupported and flexure will still occur though in a much diminished degree.

'The form I have designed and am now having constructed in the workshop follows that of Curtiss in that it is of the box form, but the design and construction of the box and the method of attachment to the telescope are different. The box is made of hard cast-steel plates (saw steel) much stiffer than brass, is rigidly braced and cross braced, and is provided with three points of support in a cradle of T iron attached to the end plate of the telescope. Two of the points are similarly situated to those of Curtiss, while the third acts near the camera end. The two first are attached by a kind of universal joint, so that no strain can be induced in the box by any bending of the cradle. The third support, near the camera, consists of a pair of counter-balancing levers, one on each side of the box, arranged to equalize the pressure on the three supports in any position of the telescope without it being possible to ever induce any strain in the box itself. By this means it is believed that no measurable or even noticeable flexure will occur.

'A simple triangular box of this form without projections of any kind is much more readily adapted for temperature regulation than the complicated shape of the regular truss form. Moreover, any stratification in the temperature case is much less likely to occur, and if it does, can not do nearly so much harm as if it were acting on only one member of the truss. A further improvement will be the introduction of a non-conducting material, such as vulcanized fibre in the supporting arms between the cradle and the box, so that heat will not be conducted away at these points and unequal temperature and possible distortions take place.

'In the present spectrograph, conduction through the arms of the truss is so great as to cause a gradual drop of the temperature in the prism box, as the outside temperature falls, of about 0·1°C. every one or two hours. The distance between the spectrograph box, which will be entirely covered with thick felt, and the inside of the felt-lined outer case will be uniform, the heating wires will be uniformly distributed, and consequently little difficulty with inequalities of temperature should result.

'Although until the instrument is completed and tested, no definite statement can be made, I have little doubt that the new spectrograph will be a considerable improvement over the present or any existing single-prism instrument.'

THE NEW SINGLE-PRISM SPECTROGRAPH.

The Optical Parts.—After the dimensions of the optical parts of the new instrument had been determined as above they were ordered from the J. A. Brashear Co., in the early part of 1908.

Some correspondence was carried on in regard to the 'Isokumatic' Collimator objective in reference to the yellowish colour of the middle component. It was, however, decided to use it in preference to the less absorbing ordinary objective, on account of the flatter colour curve given by the former. Consequently an 'Isokumatic' of 51mm. (2 inches) free aperture and 765mm. focus was ordered and received at the same time as the other optical parts, about the end of last March. Although no direct tests have as yet been made, there is no question of its being a first class objective, as otherwise the good definition now obtained would not be possible. The prism of Jena glass O. 102 had its angle 63° 30′ computed, so that the central ray for this instrument, λ4325 had a deviation of 60°. The length of the side of the prism was made 110mm.,

so as to transmit the full pencil from the collimator, and the height 57mm. in order that any effect produced by pressure or unequal temperature of the supports might be minimized. The prism is a beautiful piece of glass and the tests have shown it to be of first rate optical quality, and fears as to its possible lack of homogeneity groundless.

The camera objective, owing to the excellent performance of the Brashear Single Material in the previous instrument, was chosen of the same type and is of 57mm. aperture, a sufficient margin above 51mm. to transmit the full usable pencil, and 455mm. focus. It was tested soon after being received and, although it gave a flat field, the definition was not as good as that given by the original objective, and a preliminary test showed this to be due to spherical aberration. The objective consists of two widely separated converging elements of very light crown glass, and consequently the resulting positive aberration can only be removed by departure from spherical surfaces. The amount to be removed in the case of the original objective of 45mm. aperture and 525mm. focus was quite within the possibilities of ordinary figuring, but when the aperture ratio is increased to so large an extent as from $f12$ to $f8$, it becomes a much more difficult problem to deal with. In this case it was only after the introduction of a special method and with the great personal skill of Mr. McDowell in figuring, that the aberration was finally removed, and the objective gave practically perfect definition and a widely extended flat field. A full description of the tests, with the plotted fields resulting from different objectives, is given in full in another place.

The Guiding Telescope.—Instead of reflecting the light used for guiding down a tube parallel with the collimator and there further reflecting it to the guiding telescope so placed as to also receive light reflected from the front surface of the prism, the guiding telescope has in this case been placed about 15cm. above the slit, where star light coming from the inclined speculum-metal jaws is reflected by a right-angled prism to a small objective placed at its focal distance along the optical path from the slit. The resultant parallel pencil is then received by the bent guiding telescope shown, Fig. 2, which can be rotated to any convenient direction. Two reflections are hereby avoided, resulting in some saving of light and probably better definition. It had been found in the previous instrument that the method of guiding by light reflected from the front prism surface was never used, and consequently in the new spectrograph this needless complication was omitted. It may be said, however, that the position of the guiding telescope is in some positions of the equatorial, not quite so convenient as if it were lower down.

The Comparison Apparatus.—Experience has shown that in actual work more than one metal is never used as electrode, and consequently the rotating wheel with four sets of electrodes used previously has been omitted here, and one pair of adjustable electrodes of the alloy of iron and vanadium, whose spectrum is exclusively used for comparison, has been substituted. These terminals are mounted on a brass plate which swivels on two points attached to the top of the guiding telescope, and when not in use is simply turned back upon the latter, thus leaving the star light unobstructed. Directly below the terminals in the optical axis is screwed the short tube shown, in the upper end of which is a piece of ground glass and in the lower a small condensing lens with an angular aperture twice that of the collimator. Both of these are adjustable and ensure in every case a uniform pencil of spark light incident upon the collimator objective and prism.

Slit and Slit Diaphragms.—The slit is of the Huggins type of reflecting slit, with polished speculum metal jaws inclined at an angle of 3½°, so that the reflected pencil of star light and consequently the prism which intercepts it is entirely out of the way of the direct pencil. One jaw is fixed and the other movable micrometrically, a single division representing ·001 inch (·025mm.). The slit has a tangent screw slow motion to enable it to be placed exactly parallel to the refracting edge of the prism, and is very

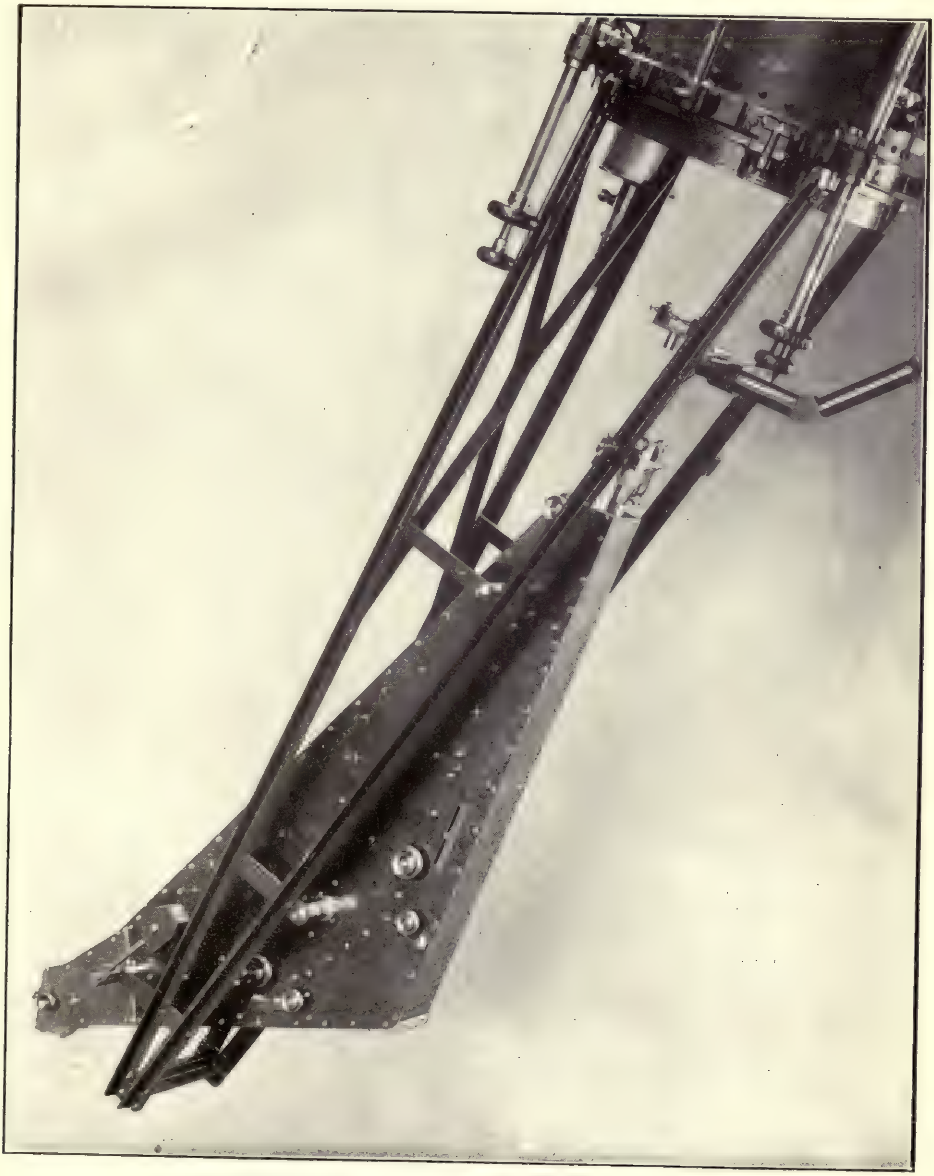

FIG. 2—New Single-Prism Spectrograph.

FIG. 3—New Single-Prism Spectrograph.

rigidly attached to the end of the heavy collimator tube. To the end of this tube is also screwed the attachment holding the sliding diaphragms, which serve to limit the star and comparison spectra. Rectangular openings of the proper width, in this case a single opening 0·4mm. for star spectrum and two openings 1·5mm. separated by a tongue 0·45mm. for comparison spectrum, are placed directly opposite one another on a plate which is moved by means of a knurled wheel transversely between stops across the slit. To expose the spark spectrum all that is necessary is to turn down the spark apparatus, turn the knurled wheel above mentioned about a quarter turn, and close the switch which controls the current through the step-up transformer used for producing the spark, this switch being on the telescope tube about a foot above the spark apparatus. To change back to star spectrum the operations are reversed, the whole cycle occupying only about ten seconds.

The Mechanical parts.—As outlined above the instrument consists essentially of two parts—1. A rigid, hollow, triangular shaped, steel box containing at the obtuse angle the prism, and at the two acute angles the slit and plate and comprising the spectrograph proper; 2. The T iron frame or cradle attached to the end plate of the telescope, in which the spectrograph proper is flexibly supported, and which serves to keep it collimated without flexure of this support producing any stresses in the box itself.

The Spectrograph Box.—The box consists of two triangular shaped plates made of hard saw steel about 1·7mm. thick forming the sides, while the edges consist of plates of the same material and thickness, 79·4mm. (3⅛ inches) wide. In addition to the edges there are a number of internal braces and supports of the same material, well shown in Fig. 4, which gives a good idea of the construction of the box. These braces as well as the edges of the box have pieces of small angle iron securely riveted along both edges, to which the side plates are firmly screwed. These angle irons are not shown in the figure, as the frame was first put together, the angles then riveted on and finally the plates screwed to these angles and to the internal castings, the heads of the screws being shown on the side of the box in Fig. 2. It was constructed in this manner to prevent as far as possible any internal stresses in the frame of the box. In addition there are iron castings *A, B, C, D, E, F,* Fig. 4, planed to exactly the same width as the edges and braces. *A,* may be called the main casting, having a hole bored through the centre through which the principal supporting shaft passes. The two legs projecting from the triangular part are bored out to fit the collimator and camera tubes. The casting, *D,* is also bored out for the collimator tube and forms the end plate of the box, while the casting, *F,* is bored out to carry the upper end of the camera tube. *C,* and, *E,* have clearance around them and do not touch the collimator tube, the upper support being attached to the centre of *C.* The part, *B,* has the third supporting shaft screwed into the centre of each side, and also forms the connection between the box proper and the camera end. The latter is made separate, so that camera objectives of different focal lengths may be used if desired.

The prism is mounted in a separate cast-iron cell, but is prevented from touching the metal at any point by facings of hard rubber about 3mm. thick, and is kept in its adjusted position by hard rubber stops. It is held firmly in this position in the cell by the gentle pressure produced by three small clamp screws passing through the top of the cell and bearing upon one of the facings of hard rubber 3mm. thick, above mentioned, resting on top of the prism. The base of the cell is surfaced flat, and rests in its compartment on one of the side plates, to which it is rigidly attached by five screws passing through slotted holes to permit of adjustment for minimum deviation.

Collimator and camera tubes are provided with racks and pinions for adjustment, their position being read on millimetre scales, the one attached to the camera being provided with a vernier, reading to tenths of a millimetre. The collimator tube is provided with two clamp screws, one at the top and one at the bottom bearing, while

the camera tube has a single clamp screw at the front end. The pinion and clamp wheels and the scales are well shown in Figs. 2 and 3. The camera attachment, whose form and construction can be fairly well obtained from Figs. 2 and 3, is built in box form of the same material, and is firmly screwed to the casting, *B*, Fig. 4, it and the spectrograph box thus forming what is to all intents and purposes one continuous piece. Between the sides of the camera box, swivels the plate holder attachment which is quite similar in form to the one used with the other spectrograph. It consists essentially of a semi-cylinder 79·4mm. long, 101·6mm. diameter, pivoted along its axis between the sides of the box to permit a wide range in plate inclination. This cylinder is constructed from a section cut from a piece of 4-inch brass tubing, on the ends of which pieces of heavy brass plate are screwed and soldered, and on the plane of section is fastened the brass camera back provided with screws for clamping the holders firmly in place. The plate holder carrier has solidly constructed ways permitting lateral movement of about 15mm., enabling a number of narrow spectra to be made side by side on the same plate if desired. The axis on which the camera back rotates is provided with knurled clamping wheels, while other screws moving in concentric slots enable adjustment and firm clamping to be effected in any desired position, read off on graduations on the cylinder.

As will readily be seen from its design and construction and from the character of the material from which it is made, this spectrograph is exceedingly rigid and the flexure produced by changes of position, however supported, would be very small. This flexure, however, is reduced to a vanishingly small quantity by the new supporting system used in this instrument. The self-contained spectrograph box is, as has been indicated above, supported flexibly on three points in the carrying cradle.

The Supporting Cradle.—This truss made of $1\frac{3}{8}''$ T steel is attached at the upper end to a heavy ring casting, which is fastened by the same three swivel bolts used for the other spectrograph to the end plate of the telescope, the mode of attachment being shown in Fig. 3, which with Fig. 4, well shows the form of the truss. It is evident that the only flexure of this truss in a direction parallel to the sides of the spectrograph will be that due to the extension of one arm and compression of the other in each pair, and this will hence be very slight. Owing to the fact that these two pairs of trusses had to be separated about 20cm. at the lower end, to admit the spectrograph with outside temperature case between them, it is evident that flexure in a direction at right angles, parallel to the movement in right ascension, will be greater. This is minimized as much as possible by joining the two ends by a solid webbed casting and by introducing cross braces at the upper end of the truss as shown. At small hour angles, however, which it is desirable for many reasons to use as far as possible, the component of the weight in this direction will be very small and the flexure negligible. Even at large hour angles which are sometimes required, the flexure cannot be great. In any case from the method of attaching cradle and box, to be presently described, no flexure of the cradle can induce any stresses in the box and the only effect of such flexure will be to slightly alter the axis of collimation of the spectrograph. This can not, however, induce any displacement of the spectral lines, not only on account of its relatively small magnitude but also because it can occur practically only parallel to the spectrum lines and to the refracting edge of the prism, which will have no effect on the position of the line.

The principal and central support and connection between cradle and box consists of a shaft 1 inch (25·4mm.) diameter passing through the hole in the main casting. This shaft is left the full size of the hole only for about 2mm. at the centre, so that the box is free to swivel in every direction around the centre to the extent of 2 or 3 degrees. This swivelling motion is, however, limited, by projecting points on the shaft at the ends of the hole, to one parallel to the motion in right ascension and to the slit, rotation around the axis of collimation being prevented. Consequently any flexure of the cradle can not induce any distorting stress in the box.

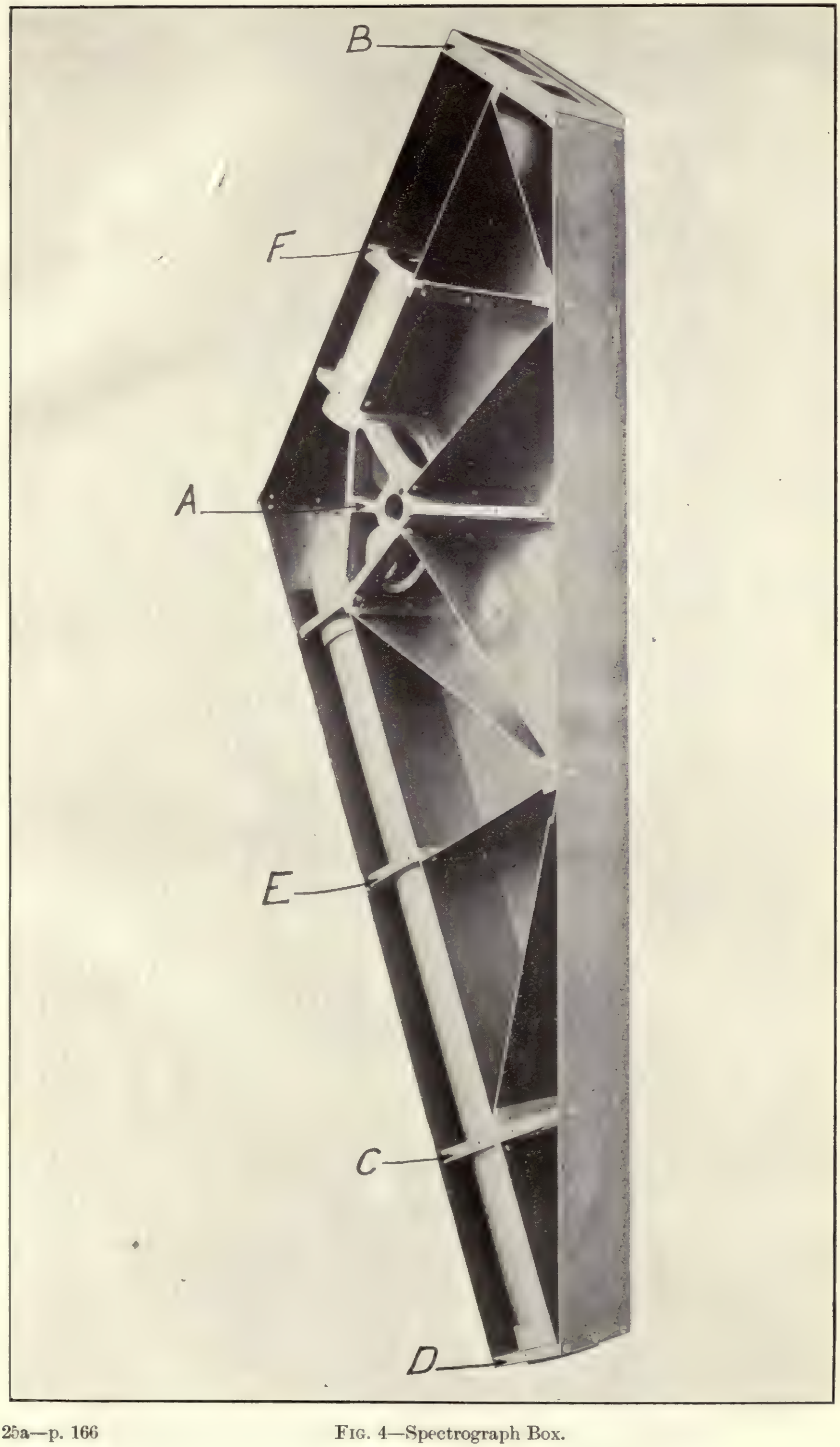

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FIG. 4—Spectrograph Box.

The upper supporting shaft has a transverse hole in the centre through which a pin screwed into casting C passes, thus allowing longitudinal motion parallel to the axis of collimation as well as swivelling motion in every direction.

The third point of support consists of shafts rigidly screwed into the centre of each side of casting, B. A second short shaft at each side carried by plates screwed to the cradle, as shown (Figs. 2 and 3), is placed about 2·5cm. from the first in a direction which, if produced would nearly pass through the centre of mass of the box. A lever attached to these two shafts at each side in such a way as to allow more than sufficient motion without binding, carries a counterbalancing weight, the combined resultant upward thrust of the two on the box being computed to equal the proportional part of the weight that should be carried by this support.

The box is hence carried equally on the three supports without any possibility of distortional stresses occurring in it due to flexure of the cradle, the only effect of such flexure being to slightly change the axis of collimation, which at the utmost can only induce displacements of the second order in the position of the spectral lines.

Temperature Control.—Every precaution having been taken, successfully as will be seen later on, against flexure, there remains, as the other main cause of systematic displacements possibly more dangerous than flexure, displacement due to changes of temperature in the optical and mechanical parts of the instrument. The changes in temperature between day and night or even between evening and morning at Ottawa are considerable, averaging about 8°C. for the former and 6° for the latter. In many cases the temperature in the dome becomes 10°C. lower than that in the temperature case, rendering satisfactory maintenance of constant temperature in the case a difficult matter.

As mentioned in the two previous reports, such difficulty was experienced and the temperature in the prism box dropped gradually about 0·1°C. per hour as the temperature in the dome became lower. When practically the whole of the inside of the case was covered with the heating coils this drop was not so great, but was not entirely overcome. It was believed to be due to the conduction of the heat through the metal parts of the attaching truss, the collimator tube, &c., exposed to the outside air and that, although the temperature inside the case undoubtedly remained nearly constant, the temperature inside the prism box would diminish with the lowering of the outside temperature owing to the greater loss of heat through the exposed supports.

To overcome this as far as possible in the new instrument all of the shafts attaching the box to the cradle were cut at points about 3cm. from the box, just inside the outer case, were bored out and threaded, and a piece of vulcanized fibre separating the ends about 7mm. screwed in. This fibre, seen dark on the shafts in Fig. 3, is a poor conductor of heat, prevents direct metallic conduction from the box inside the temperature case to the cradle outside, and the only part of the spectrograph exposed is the slit head. The temperature inside the outer case is automatically controlled by a pair of electric contact thermometers placed not, as in the previous instrument, one on each side of the prism box, but one in the front near the upper end and one at the back near the camera.

Each of these thermometers controls the heating coils in the corresponding half of the outer case. It was hoped by thus arranging the thermometers and coils to keep the temperature over the whole interior of the case more nearly uniform than previously. These thermometers act in exactly the same way as in the former instrument described in the 1907 report. When the temperature in the case rises the mercury in the open capillary makes contact with an adjustable platinum wire and the resulting battery current attracts the armature of a relay, thus breaking the heating circuit; similarly when the temperature falls the mercury recedes from the platinum terminal, the relay armature is released and current is turned on the heating coils. In practice the regulation is very good, current in the coils as indicated by pilot lamps being turned on and off every few seconds. To smooth down any remaining irregu-

larities the whole exterior of the spectrograph box is covered with a layer of half-inch thick felt, small hinged doors being made over the indexes and scales of collimator and camera.

The temperature case is in this instrument constructed of wood chiefly on account of its greater ease of construction, of its greater heat insulating power, and of the smaller danger of short circuits in the heating coils over one made of aluminum. Moreover, owing to the simple form of the spectrograph, a wooden case can easily be made amply strong. This case is made of ½-inch thick pine, lined inside with felt about ⅜-inch thick and is divided into three sections, the line of junction of the body of the case necessarily following the supporting shafts. The third section, which was necessary for constructional reasons, is a small box-shaped piece at the camera end. All joints between the sections and the joints around the doors in the case, necessary for the adjustment and clamping of collimator and camera and of the contact wires in the thermometers, are carefully padded with felt to be air-tight. This case, which is shown in Fig. 5, is attached securely to the supporting cradle and does not touch the spectrograph proper, the openings around the end of the collimator tube and the supporting shafts being made large enough for free clearance and at the same time heat-tight by washers of felt.

On the felt lining on the inside of this case is stretched about 1,200 feet No. 28 single silk covered German silver wire, arranged in four circuits of 300 feet each, two of these circuits in multiple are controlled by each of the electrical contact thermometers, each governing the coils in its own section of the case. This wire is distributed as uniformly as possible over the inside of the case, the space between the felt coverings of the case and spectrograph being about 2·5cm. and uniform throughout. By the division of the heating coils into two sections, their uniform distribution, and the uniform space between spectrograph and case, the temperature throughout the case should be maintained nearly uniform and not much trouble with unequal temperature should occur. There is no question that some method of mechanical stirring of the air inside the case would give better results, but the difficulty of additional weight and complication with possible vibration prohibit its use.

The temperature control so far as it has been tested works admirably. There is as before a slight drop in the temperature of the prism box when the external temperature drops rapidly, but that does not last long, and by applying the control in the afternoon, thoroughly ventilating the dome so that considerable of the cooling will have taken place, the temperature remains steady for the night.

Adjustment of the instrument.—After the instrument was completed there were several adjustments to be made before any measurable spectra could be obtained. The first of these was to set the slit at the principal focus of the collimator lens. This was done by Schuster's method of alternate focussing of collimator and observing telescope on the same spectral line, the prism being placed alternately to one side and the other of the position of minimum deviation. This method gives satisfactory results, successive values agreeing within two or three-tenths of a millimetre and the mean of several being taken. The prism was easily set to minimum deviation for the line *Fe*, 4325·9. This particular line was chosen on acount of the very irregular results given by the line H_β in the numerous measures of β Orionis, and the consequent determination to shift the central line towards the violet in the new instrument. The measures above referred to show that more accordant results are obtained with the lines to the violet end of the spectrum than with H_β, and as resolving power, purity, and linear dispersion are all greater there, this should result in a further increase in accuracy. The camera focus is determined in precisely the same way, as with the previous instrument, by making adjacent spectra through the refracting edge and base half of the prisms, and determining the focus by the continuity of the lines. A slit is cut in the side of the spectrograph box into which a semicircular diaphragm can be

FIG. 5—New Single-Prism Spectrograph, ready for use.

placed and rotated, so as to occult first one and then the other half of the light pencil. The inclination of the plate, determined of course at the same time, is about 16°·5, the same as with the first objective of this type.

A very curious and at the same time very useful property of the new spectrograph is the constancy of focus of the system for different temperatures. With the two previous instruments, the focal setting increased with increase of temperature about ·012mm. per degree centigrade. Between the temperatures of 0° and 20°, all so far tested in the new spectrograph, the camera setting remains unchanged at 27·69 as determined by a number of careful tests. This with the absolute constancy and rigidity of the new instrument is a point of very great value in obtaining accurate results, as it obviates the necessity of testing the focus each time the instrument is used with the possibility of mistakes in the determination of the true setting. It is difficult to explain why there should be this difference, although it is probably due to the fact that the parts connecting camera objective and plate are of steel in the new instrument instead of brass, whose coefficient of expansion is greater. At any rate the combination of brass collimator tube, whose setting is unchanged, and steel camera tube gives settings for camera focus constant at all temperatures so far observed. If the collimator tube had been steel or the camera tube brass, there would have undoubtedly been a change in the setting with change of temperature.

The New Spectrograph in practice.—As stated above the instrument was only completed in the beginning of March, and consequently has not been in use long enough to enable its advantages and disadvantages to be fully determined. There is, however, no question that spectra of better quality for measurement will be obtained with it than with the single-prism form of the previous instrument in which the lines were occasionally, especially with the longer exposures somewhat blurred and diffuse, due to flexure or temperature change or both. As will be seen later, flexure in the new instrument is absent, and owing to its compact form any temperature changes should have much less effect on line displacements. As a matter of fact the temperature regulation is much better with the new instrument and no spectra yet obtained, even with very long exposure, show any trace whatever of diffuseness of the lines. Again, the constancy of the camera focus is another factor tending to better results, as one is always sure of the true focus and no fear of systematic displacements due to poor focus can arise.

Tests have been made similar to those of last year, on the relative freedom from accidental and systematic errors of spectra made at different slit-widths. These show, that on the whole in early type stars with this instrument more accurate values are obtained with a slit about 0·051mm. wide than with slits narrower or wider. The comparative exposures required with the new instrument at slit-width 0·051mm. and the previous single-prism instrument at slit-width 0·038mm., which gives about the maximum accuracy obtainable with it in early type stars, shows an advantage, so far as can be at present determined, of about 25 per cent for the new instrument. To offset this, however, it must be stated that, owing probably to the increased absorption of the larger prism, the intensity of the spectrum at the violet end is appreciably less and for equal intensity of the K line, sometimes required, most of the advantage will be lost. In the case of stars in which the extreme violet is not required, however, there is a considerable saving in time and increase in output by the use of the new instrument. This loss in the violet may be due possibly to other causes than absorption of the prism, such as in the guiding or the position of the corrector and form of the colour curve, and if such is the case, and this will be shortly tested, it may to a great extent be overcome.

Careful tests of the flexure of the new instrument have been carried out showing exceedingly satisfactory results. The method of testing was to attach the spectrograph to the telescope, the latter being pointed to the meridian. If the telescope is

turned in declination pointing first to the south and then to the north horizon, it is evident that the spectrograph will have rotated in its own plane through 180°, and there will have been induced in it the maximum possible double flexure. In these two positions spectra were made through a suitable slit diaphragm, the one used for focussing in which the adjacent spectra touch each other being the best, as any displacement of the line between the two exposures will at once be evident. Three sets of exposures of the comparison spark were made on the one plate, by sliding the camera back in its ways between exposures, two for flexure and one with the spectrograph stationary for comparison. Examination of these plates showed no measurable flexure. In some of the lines a very slight displacement could just be detected under high power magnification, but this if due to flexure was quite beyond measurement. As a matter of fact, on the plate being given to Mr. Harper with the request to select from the three the spectrum in which no movement had occurred, he found it impossible to determine which spectra were affected by flexure. As the flexure present during any reasonable exposure can only be a small fraction of that given by the method above described, it is quite evident that the spectra will be absolutely free from any line displacement due to flexure of the spectrograph. It may be of interest to state that flexure tests made of the instrument with the counterbalancing weights removed, and with consequently only two points of support, also showed remarkable freedom from flexure. Although the flexure was slightly more perceptible it was again quite immeasurable, showing the great stability and rigidity of the form of construction adopted.

The previous single-prism spectrograph showed when first constructed a flexure of about ·035mm., equivalent to a velocity of 70km. per second. When tested at the same time as the new one it was found the flexure had increased to nearly ·060mm., equivalent to over 100km. per second. As a displacement of the sharp comparison lines equivalent to a velocity of two or three kilometres would be measurable, it is at once seen how much more stable the new instrument is. It is, so far as I can learn, more stable than any other single-prism spectrograph in existence.

The new single-prism instrument, owing to its greater aperture and its design, is necessarily heavier than the three-prism spectrograph and some changes were necessary in the arrangement of the counterweights for balancing. As will be seen from Figs. 2 and 5, the centre of mass is considerably to the left of the optical axis, and in order to properly balance in declination, weight would have to be added to the opposite side of the tube near the object glass. Consequently rods for carrying weights were attached to both north and south sides of the tube near the objective, and the telescope can now be easily placed in good balance whatever attachment is used.

A counterweighted stand for attaching and detaching the new spectrograph, and for carrying it when not in use is provided. It is of quite similar construction to that used with the previous instrument, and allows the spectrograph to be fastened to the telescope in about a minute. With the separate relay box and set of plug contacts, both spectrographs may be maintained at constant temperature, and the change from one prism to three prisms or vice versa made in two or three minutes without disturbance of the temperature regulation in either case.

There will now be given the results of the tests of the new 'Single Material' and the 'Ross Special Homocentric' lenses, and, for completeness, the whole paper, as it will later be published in the Astrophysical Journal, will be given.

CAMERA OBJECTIVES FOR SPECTROGRAPHS.

It is well known that the camera objectives in general use in stellar spectrographic work have a very limited field of good definition, not exceeding in general 2°, which covers, in the usual dispersion of three prisms, about 200 tenth-metres. While this is a sufficient range for spectra of the second type, which are rich in lines, it is not sufficient for early-type spectra which may contain only one or two lines in this region, and in which, consequently, the errors of measurement will be high. As practically

the whole photographic region of the spectrum, $H\beta$ to K, may be obtained in one exposure with either refractor or reflector, it is evident that a considerable gain in the measurable material in such spectra would be obtained, without increase in exposure time, if a camera lens giving a considerably wider field were available.

Various attempts at the solution of this problem have been made, of which the most successful known to me is that described by Hartmann.* This objective made by Zeiss, known as the 'Chromat,' is constructed of the same material as the prisms, and is composed of two simple meniscus elements, one positive, one negative, separated by a small air space. As there is no chromatic correction the spectra are brought into focus by inclining the plate towards the violet about 16° from the normal to the axis with a dispersion of three prisms. According to Hartmann this objective gives a flat field of 14°. A Zeiss 'Chromat' has been in use in Ottawa for considerably over a year, entirely fulfilling expectations and giving, after slightly increasing the separation of the elements, the whole field used, from $H\beta$ to $H\delta$ (about 8°), almost absolutely flat with excellent definition. There can be no doubt that the field would extend farther if necessary.

Unfortunately, as was learned upon inquiry from Zeiss, this type of objective cannot be successfully made of a larger angular aperture than about $f12$. This was confirmed by the performance of a shorter focus lens of the same type (aperture ratio $f8$) constructed by Brashear which gave inferior definition. More recently, however, Ross Limited, London, have designed and constructed especially to conform to our requirements a lens similar in form to their 'Homocentric,' consisting of four separated elements, but following the principle of the 'Chromat' in being entirely made of the prism material and consequently requiring inclination of the plate to bring the spectrum into focus. This lens, which will be more fully discussed later, gives, at an aperture ratio of $f5{\cdot}6$, excellent definition and a flat field. The above remarks apply to a dispersion of three prisms for which this type is especially adapted. If it were used with one prism, in addition to the limitations as to aperture, the plate inclination required (about 50°) would be inconvenient and practically inadmissible in radial velocity work.

There are consequently required short-focus objectives giving a flat field with three prisms, and objectives giving a flatter field than the regular triplet with a single prism. This need, together with what had already been accomplished by Hartmann and Zeiss, was laid before the J. A. Brashear Co. who, with their usual willingness, put their best efforts at our disposal and, in collaboration with Prof. Hastings, produced two eminently successful objectives. In both of these the employment of one kind of glass only is followed, although not, as in the 'Chromat,' of the same material as the prisms, and the consequent chromatic differences in focus are overcome by inclining the plate. The objective first produced, to which they have given the name 'Single Material' is composed of two widely separated positive elements of crown glass of the lowest dispersion and is especially adapted for use with one prism, giving exquisite definition and a field flat within 0·1mm. over the whole visible and considerably into the ultra-violet spectrum. The other is similar to the 'Chromat' in form but made of light crown glass, giving also a flat field and good definition with three prisms with a plate inclination of only slightly over half that of the 'Chromat.'

The limiting aperture ratio of the former of these objectives is about $f8$, of the latter $f12$, so that evidently they can not supply the need of short-focus lenses of $f6$ or thereabouts for either single or three-prism work.

The only prospect of success in this respect seemed to lie in some of the modern anastigmat photographic lenses, and a number of different makes were accordingly obtained for trial. The definition of several of these, though good enough for ordinary

* Zeitschrift für Instrumentenkunde, September, 1904.

photographic work, would not stand the critical test of spectrum photography owing probably to some residual spherical aberration. Two, however, the Ross 'Homocentric' and the Zeiss 'Tessar,' gave good definition and the forms of their fields were accordingly determined.

It may not be out of place to give a brief description of the method employed in determining the fields of the ten lenses tested. The dispersion for eight of them was produced by the Ottawa spectrograph, having the following optical constants:—Hastings 'Isokumatic' collimator objective of 35mm. aperture and 525mm. focus; one or three prisms of Jena glass O. 102, angles 63° 50′ each; ray at minimum deviation λ4415. Two of the objectives were tested with a new single-prism spectrograph having 'Isokumatic' collimator of 51mm. aperture and 763mm. focus, O. 102 prism of angle 63° 30′, ray at minimum λ4325.

The positions of focus in different parts of the field were determined by a modification of Hartmann's method* of extra-focal exposures. By means of a revolvable semi-circular diaphragm behind the collimator lens and an occulting diaphragm in front of the slit, a narrow strip of spectrum, photographed through the half of the prisms near the refracting edge, was placed between and touching two narrow strips made through the base half of the prisms. Evidently, when the plate is in the focus of the camera lens for any particular line in the spectrum, the adjacent portions of this line will be continuous, while, if not in focus, the central section will be displaced to red or violet of the outside sections, the direction and magnitude of this displacement giving a measure of the position of the focal point for the line in question. Two such plates, one inside and one outside the focus, will suffice to determine the form of the field. In order to avoid the labour of measurement and computation and on account of the diffuseness of the lines and consequent inaccuracy of measurement, when the plate is more than a millimetre from the focus, I have generally preferred to make a number of spectra, by the method outlined above, at camera settings about 0·25mm. apart within and without the focus. Five of these have in general sufficed to determine the focal curve and, as the camera back can be moved laterally, they can all be made on one plate, thus allowing ready comparisons. Simple inspection of these spectra under a microscope or even by a hand magnifier enables the focus of any line to be determined to about 0·05mm. by observing at which of two successive spectra the central section has opposite displacements with respect to the outside sections. Interpolation to the above accuracy can then generally be made. This takes only one-tenth the time and is probably equally as accurate as the method of measureing the displacements and computing the distance from focus. I may say that the camera setting in our regular work is always determined in this way, enabling the plate to be certainly placed considerably within 0·1mm. of the true focus.

This method is probably open to the objection that it will not give the true focal point when the system has aberration, but it must be remembered that, to prevent systematic displacements in radial velocity work due to non-uniform illumination of the collimator objective, this method, which determines the focus by the absence of such displacement, is certainly the one that should be used. Moreover, in this case tests at full aperture, so far as the focus can be determined by definition, confirmed the results of the former method, and there is no reason to doubt the accuracy of the focal curves determined.

* Zeitschrift für Instrumentenkunde, 24, 1, 1904.

The following ten lenses, given in the order of procuring and testing, were tested for their curvature of field.

OBJECTIVES TESTED FOR FIELD.

Number	Objective.	Aperture.	Focal Length.	Tested with dispersion of
1....	Brashear Single Material.....	45	525	1 Prism, 3 Prisms.
2....	Zeiss Chromat......	45	525	3 Prisms.
3....	Ross Homocentric.........	40	254	3 Prisms.
4....	Zeiss Tessar....	48	305	3 Prisms.
5....	Brashear Light Crown....	45	525	3 Prisms.
6 ...	" Telescope Flint...... . ..	45	525	3 Prisms.
7....	" O. 102 ("Chromat")........	45	375	3 Prisms.
8....	" Triplet	57	480	New 1 Prism, 3 Prisms.
9....	" Single Material	57	457	New 1 Prism.
10...	Ross Special Homocentric...........	40	254	3 Prisms.

The form of field of each of the lenses is given in the accompanying figures where the horizontal lines represent differences of focus of one millimetre, the wave length and angular distance from the optical axis are shown by the vertical lines, and the diameters of the circles representing the observed points are 0·2mm. Wherever the curves are not horizontal indicates that the inclination of the plate holder required changing slightly, but this of course has no effect on the form of the field. In order to group the curves according to the type and purpose of the objectives, the order given in the above table has been changed and those of longer focus used with a dispersion of three prisms will be first considered (Fig. 6).

Brashear Single Material (No. 1.)

This consists of two simple converging lenses, the front double convex, the rear convex meniscus, of crown glass of lowest index, separated by nearly one-third the focal length. As will be seen later, this objective gives a beautiful field with one prism, but is strongly concave towards the lens with three prisms, with about the same curvature of field as the regular Hastings Triplet. The inclination of the plate towards the violet is slightly over 5°. Allowing deviation from focus of 0·1mm., slightly over 2° of field is usable.

Zeiss Chromat (No. 2).

This consists of two strongly curved meniscus elements of Jena glass O. 102, the front diverging, the rear converging and of about half the focus of the combination. When received it gave a field convex towards the lens as shown in the upper curve. When the separation between the elements was increased from 2·25 to 4·5mm. the field became almost absolutely flat over the whole 8°, giving at the same time excellent definition. Inclination of the plate towards the violet about 16°.

Brashear Light Crown (No. 5).

This is a lens of the same form as the 'Chromat' except that it is made of light crown glass. With the original separation the field was concave but became flat on decreasing the separation from 4·8 to 3·2mm. This change in separation resulted in loss of defining power. The objective was re-figured at the new separation and gave good definition and field flat over practically the whole range. Inclination of plate to the violet about 9°.

Brashear Telescope Flint (No. 6).

An objective similar to the previous one only made of telescope flint glass. The field was originally convex but became flat on increasing the separation from 4·8 to 7·9mm. Refiguring did not give so much improvement as in the light crown objective. Field is now practically flat. Inclination of plate to the violet is about 13·5°.

Brashear Triplet (Hastings) (No. 8).

This is a lens of the same type as used in the Mills, Bruce and Lowell spectrographs. The field is, as shown, strongly concave towards the objective with a usable portion, allowing deviation of 0·1mm., of about 2·5°. The definition at the centre of the field is about the same as in the 'Chromat,' but towards the margins even when in focus is much inferior.

All the above objectives are of relatively long focus, small angular aperture, about f 12, tested with dispersion of three prisms. Let us now examine the fields given by shorter focus objectives, using the same dispersion (Fig. 7).

Ross Homocentric (No. 3).

This standard photographic objective gives good definition but a strongly concave field. An increase in separation from 59 to 124mm. appears to flatten the field, but at the expense of defining power and the lens is not usable at the increased separation. Useful field is not more than 2°.

Zeiss Tessar (No. 4).

This objective was one of the standard form taken from the stock of Bausch and Lomb. It gives good definition and a field very slightly convex. This convexity is removed by an increase in separation from 41·0 to 41·7mm., but with a slight loss in defining power, so that it is probably preferable to use it at the normal separation. Another lens of the same series, aperture, and focus was tested, giving practically the same field but considerably poorer definition. This is of interest as showing the differences between the performance of two objectives presumably identical and indicates the desirability of specially selecting and testing the lens to be used from a number.

Brashear O. 102 ('Chromat') (No. 7).

This objective of the same type and material as the Zeiss Chromat but of larger angular aperture, gives a field nearly flat with a separation of 6·3mm., but with poor definition even after refiguring. This shows that this type can not be successfully constructed of larger aperture ratio than f11, say. Inclination of the plate to the violet about 16°.

Ross Special Homocentric (No. 10).

This objective was, by the kindness of the makers, Messrs. Ross, Limited, especially computed and constructed for us. It has an aperture ratio of f5·6, is of practically the same form as their Homocentric, but with all four elements of O. 102 glass. It gives beautiful definition and a field nearly flat, usable over 8°. Change of separation is without appreciable effect on the form of field. Inclination of plate to the violet about 16°.

Two types of objectives of medium and long focus have been tested with a dispersion of one prism (Fig. 8).

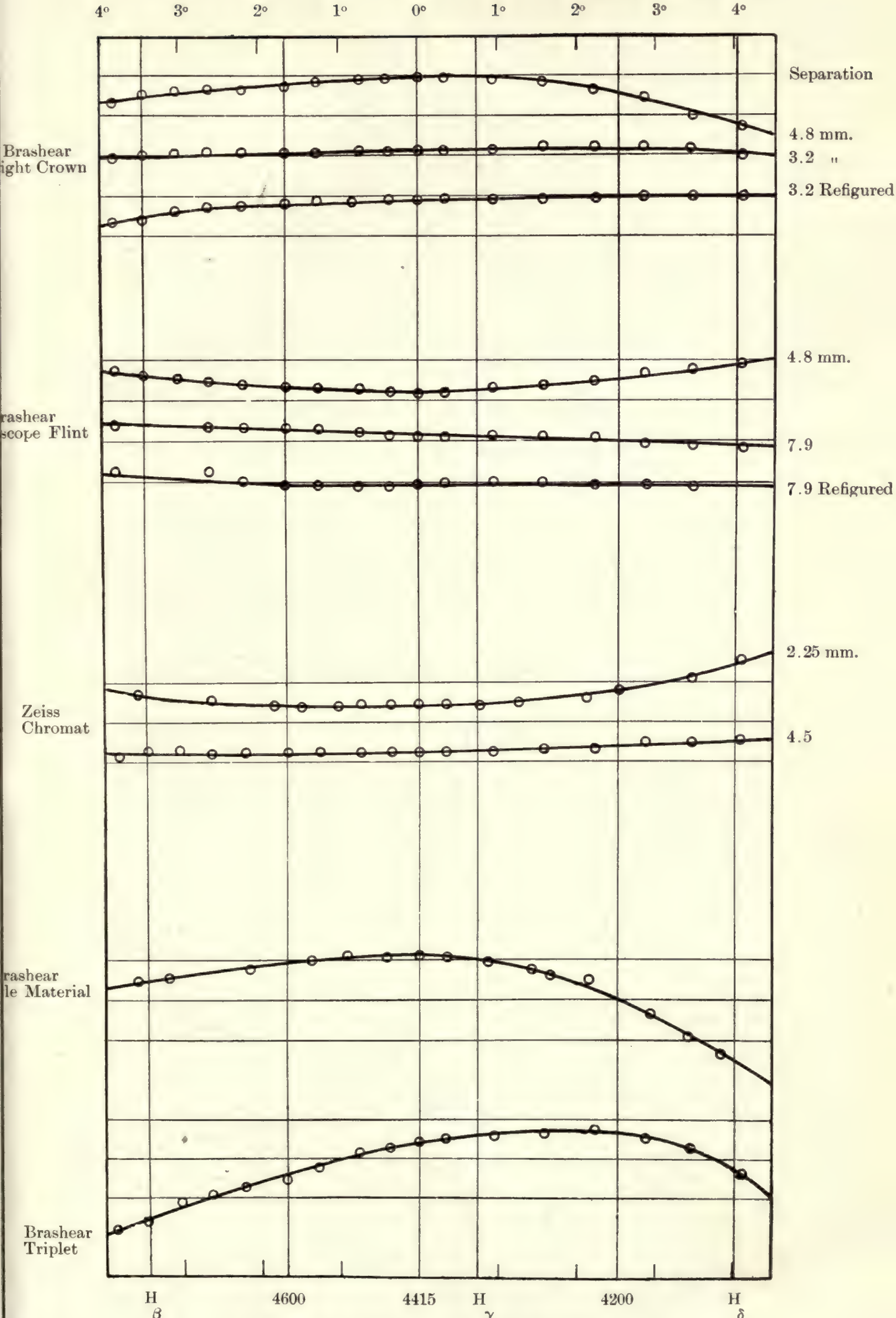


Fig. 6—Long Focus Objectives with three prisms.

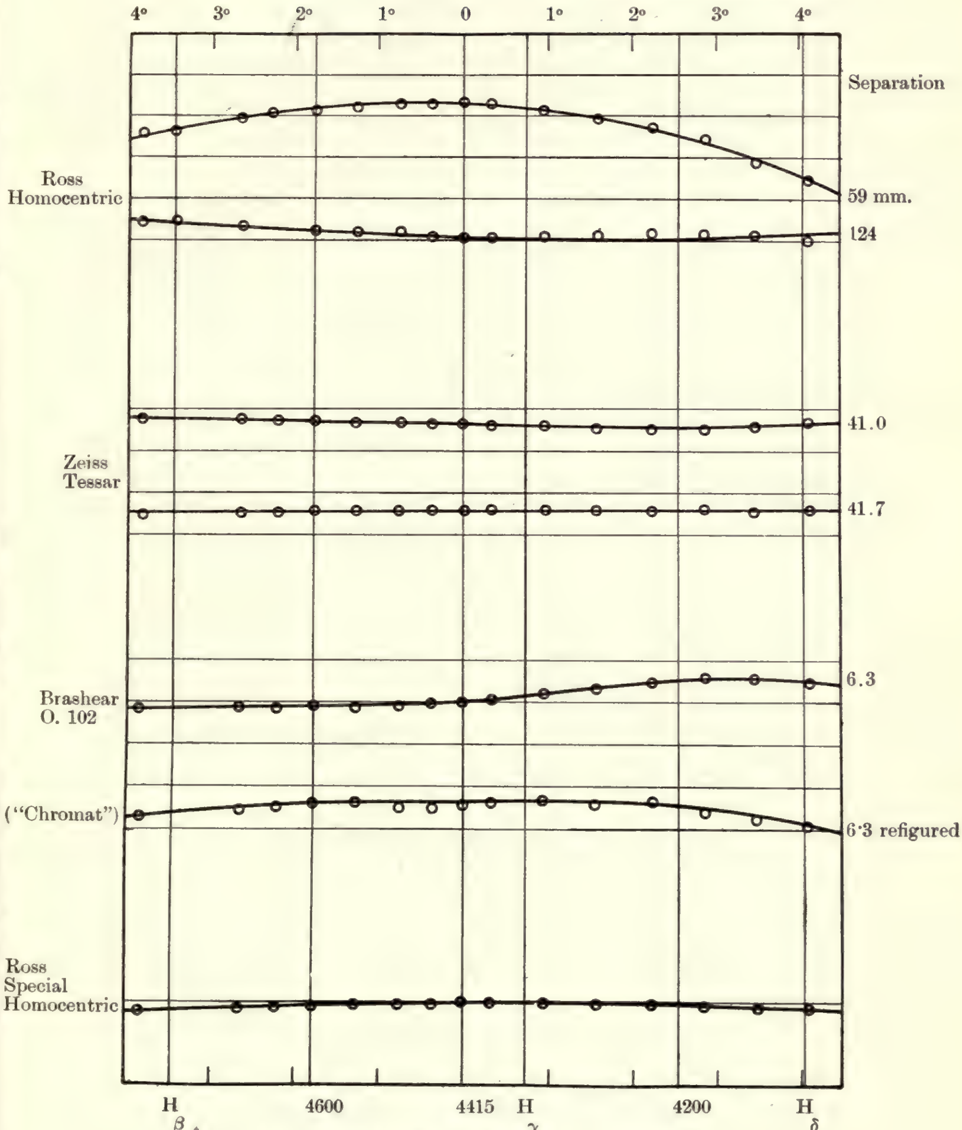


FIG. 7—Short Focus Objectives with three prisms.

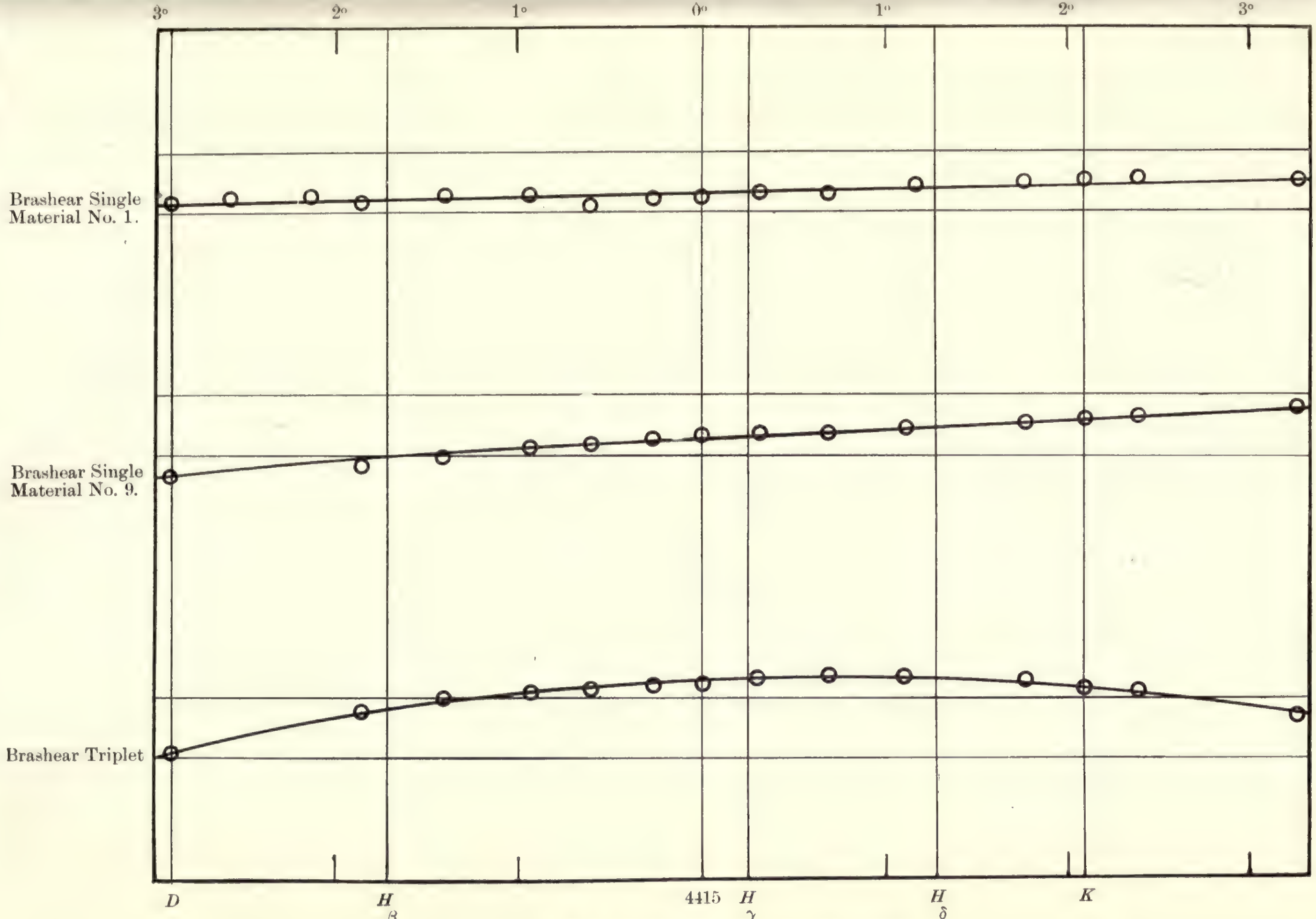


FIG. 8—Objectives tested with one prism.

Brashear Single Material (Nos. 1 and 9).

Both of these objectives, whose form was described above, are of the same type, No. 1 of an aperture ratio $f11 \cdot 5$; No. 9, $f8$. When used with three prisms they give the strongly concave field shown in Fig. 6, but with a single prism the field is almost absolutely flat over the whole range of visible and as far into the ultra-violet spectrum as the prism will transmit. The definition given is excellent and the objectives leave nothing to be desired for single-prism work. The inclination of plate to the violet is about 16°. I am glad to express here my appreciation of the efforts, as well as my admiration for the skill of Mr. McDowell in figuring these objectives. As both components are converging, the only means of removing the positive spherical aberration is by departure from spherical surfaces. While, as Mr. McDowell says, this was comparatively easy for No. 1, of the smaller angular aperture, it taxed even his skill to remove it entirely in the other, and it was only after a second trial and the use of a special device that the objective was finally made perfect.

Brashear Triplet (No. 8).

This, as with three prisms, gives a field concave towards the objective but with considerably less curvature. The usable field is somewhat over 2°. Definition good.

The final results of the investigation may be summarized as follows:—

For a dispersion of three prisms with a camera of fairly long focus two objectives are much superior to the others, the Zeiss 'Chromat' and the Brashear Light Crown. The former gives a flatter field and slightly better definition than the latter, but on the other hand the smaller plate inclination of 8° instead of 16° and the smaller absorption of the Brashear are an advantage. The definition of either of these is fully equal to the regular triplet in the centre of the field and much superior at the margins.

For short-focus lenses with three prisms both the Zeiss 'Tessar' and the Ross 'Special Homocentric' give good definition and flat fields. The Ross can be used of shorter focus than the Tessar, and gives exquisite definition, but the field of the Tessar is flatter and the plate is normal to the axis.

In single-prism work the Brashear 'Single Material' is much superior to the type of Triplet usually employed, both in definition and extent of field and can not be surpassed or even equalled for its purpose.

MEASUREMENT AND REDUCTION OF STELLAR SPECTRA.

With the exception of some plates measured on the spectro-comparator, which will be fully described below, all of the measurements have been made with the Toepfer microscope, and reduced by the modified Hartmann method previously described and explained. When the new single-prism spectrograph was brought into use it was found necessary to obtain tables, similar to those previously prepared, for the reduction of the spectrograms.

As before, plates of the comparison spectrum were made at three temperatures, as far separated as the time and season would permit, and these plates were measured. From these measures the constants of the Hartmann interpolation formula $\lambda - \lambda_o = \frac{c}{s - s^o}$ were computed, using as the three standards different sets of lines, for the purpose of determining which would give the best agreement over the whole range of spectrum. It was not thought necessary, after the work of Mr. McLean, described in the 1907 report, to use the complete formula,

$$s_o - s = \frac{c}{(\lambda - \lambda_o)^a},$$

as he showed that with the previous single-prism instruments, the best agreement was given when $a = 1$.

It was found that standards chosen at the middle and near the ends of the spectrum gave the best agreement on the whole and these, with the measures corresponding and the constants for the three temperatures, are given.

TABLE OF CONSTANTS.

Temp. C.	$\frac{4864\cdot943}{s_1}$	$\frac{4341\cdot162}{s_2}$	$\frac{3930\cdot450}{s_3}$	s_0	log c	λ_0
2·8..	75·9840	50·9383	20·5074	176·9410	5·4249320	2229·851
8·6..	75·9851	50·9168	20·4543	176·9951	5·4250393	2230·595
15·6..	75·9557	50·8696	20·3763	176·9751	5·4248560	2231·943

Forming the differences between the s's and the log. of the ratio we have:

Temp. C.	s_1-s_2	s_2-s_3	s_1-s_3	$\log \frac{s_1-s_2}{s_1-s_3}$
2·8......	25·0457	30·4309	55·4766	9·65462
8·6......	25·0683	30·4625	55·5308	9·65459
15·6......	25·0861	30·4933	55·5794	9·65452

The changes in these differences and in the log. of the ratio are only about half those given with the other single-prism spectrograph. This is undoubtedly due to the fact that the camera setting remains unchanged with change of temperature in the new instrument, and, consequently, only the change in the angular dispersion appears, instead of that due to angular dispersion plus that due to increase in distance of the focal plane from the camera objective.

Averaging up the differences as far as possible, an increase of temperature of 1°C. increases $s_1 - s_3$ by ·008 revolution, and diminishes $\log.\frac{s_1 - s_2}{s_1 - s_3}$ by·00001.

Forming an arbitrary series with these differences from the last two columns of the previous table, keeping them as close as possible to the observed values and computing 2nd and 3rd columns we have for differences of 10°.

Temp. C.	s_1-s_2	s_2-s_3	s_1-s_3	$\log \frac{s_1-s_2}{s_1-s_3}$
−10....................................	25·0070	30·3675	55·3745	9·65475
0....................................	25·0376	30·4169	55·4545	9·65465
+10....................................	25·0681	30·4664	55·5345	9·65455
+20....................................	25·0985	30·5160	55·6145	9·65445

Again, taking the arbitrary equidistant values of s_2 for these four temperatures, which make the micrometer reading for the iron line at minimum deviation λ4325·9

as near as possible to 50·0000, we obtain the following values for s_1 s_2 s_3 and from them the three constants of the formula:—

Temp. C.	s_1	s_2	s_3	s_0	log c	λ_0
−10	75·9260	50·9190	20·5515			
0	75·9516	50·9200	20·5031	176·9129	5·4250327	2229·197
+10	75·9891	50·9210	20·4546	176·9736	5·4248342	2231·163
+20	76·0205	50·9220	20·4060	177·0327	5·4246277	2233·137

From these constants were computed the micrometer readings for all the star and comparison lines employed, and in addition the velocities corresponding to one revolution of the micrometer screw for each star line. This latter is obtained by differentiating the dispersion formula and applying Doppler's principle resulting in

$$v = \frac{299860}{\lambda} \cdot \frac{(\lambda - \lambda_0)^2}{c}$$

The velocities per revolution, as compared with those for the original single prism, are given for a few lines below to give some indication of the difference in dispersion.

Velocities per Revolution.

Temperature + 10° C.

Wave Length.	Old One Prism.	New One Prism.
4861·527	1454·4	1604·5
4713·308	1336·6	1473·7
4549·766	1209·0	1332·1
4481·400	1156·5	1273·9
4395·286	1091·1	1201·3
4340·634	1050·1	1155·8
4260·640	990·6	1089·9
4202·161	947·7	1042·3
4143·928	905·4	995·4
4101·890	875·2	961·9
4026·352	821·5	902·4
3970·177	728·1	858·3
3933·825	756·0	830·9

These velocities show that the new instrument has very approximately ten per cent less linear dispersion than the old. This, of course, is due almost entirely to the shorter focus camera lens used, as the prisms are nearly alike and the angular dispersion similar.

The Spectro-comparator.

The Spectro-comparator, which was briefly referred to in my last report, has not been used except on a few plates of β Geminorum more to test the capabilities of the instrument than for the purpose of obtaining definite measures of the velocity of this star. Before giving these measures, however, it may be well to shortly describe the instrument, its principle and the methods of measurement. These have been very fully described by its inventor, Dr. Hartmann, in the publications of the Astrophysical Observatory of Potsdam, Volume XVIII., Part 1, and consequently need not be gone into in great detail here.

The principle of measurement depends upon the direct comparison in a special form of double image microscope of the star spectrum, whose velocity is required with a standard spectrum of the sun, whose velocity at the instant the spectrum was made,

can be readily computed. The difference in the displacements of the star and the sun lines with respect to the same metallic comparison lines on each plate is measured by a micrometer screw, and this linear displacement can be at once converted into kilometres by multiplication by a known or easily computed constant. By adding to this radial velocity that of the sun with respect to the earth, with the proper sign, we obtain the velocity of the star with respect to the earth, and this can be readily reduced to the sun in the well known way.

The instrument of which a photograph is shown in Fig. 9 and diagrams in Figs. 10 and 11 was constructed by Zeiss in a very workmanlike manner. It consists essentially of a table T, Fig. 10, which carries at E_1 and E_2 the standard solar and the star spectrum respectively, and of a single ocular double objective microscope carried above the table on the bracket R, Fig. 11, which combines and compares the images of the two spectra.

The table T, which as Fig. 11 shows, is inclined at 45° to the horizontal for convenience in measuring, slides at its lower portion on the steel cylinder Z 35mm. diameter and at its upper part on the steel bar J. It is moved on these bearings over a range of 12cm. by rack and pinion of which the knurled wheel is shown at K and is clamped in any position, read off on the scale and vernier N, by the clamp screw near K. At the upper part of the table a carriage B_2 slides transversely in ways, adjustment being made by the screw G, while a secondary carriage A_2, having a slit 1cm. wide and 12cm. long, through which the star spectrum is illuminated by the plane mirror shown in Fig. 11 is oriented by the tangent screw D_2 and the opposing spring F_2, so that the spectrum, clamped on it may be placed parallel to the motion of the table T. The carriage B_1, which carries the standard or fundamental solar spectrum, has an orienting table A_1, adjusted by the screw D_1 and spring F_1, and slides in ways parallel to the motion of the table T. It is moved by means of the micrometer screw S of 0·5mm. pitch, having a range of movement slightly over 2cm. The head is divided into 100 parts so that the movement of the sun spectrum can be read direct to 0·005mm. and estimated to 0·0005mm.

The double microscope, Fig. 11, by which these two spectra are observed is supported by the bracket R on which the arm R_1 slides, moved by the screw H, the position being read on the scale W. The tubes carrying the objectives O_1 O_2 are attached at a fixed distance from one another to a plate L, movable in ways on the arm R_1 by the screw Q. At the upper ends of the objective tubes, which are provided with rack and pinion movement for focussing, are the prisms P_1 P_2, which reflect the light from the spectra on E_1 and E_2 to the compound prism P_3 P_4. On the hypothenuse of the prism P_4 is a surface silvered in the form shown in Fig. 12, and the two prisms are then

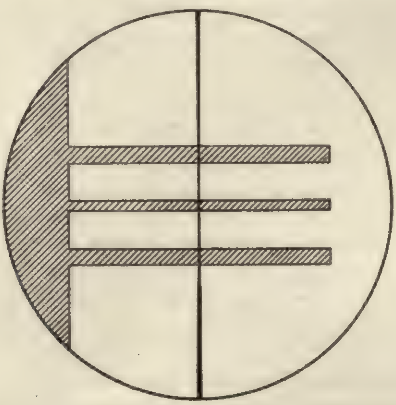


Fig. 12.

cemented together with Canada Balsam. The proper proportioning of the widths of the silver strips enables one to see, on looking through the eyepiece, a narrow strip of

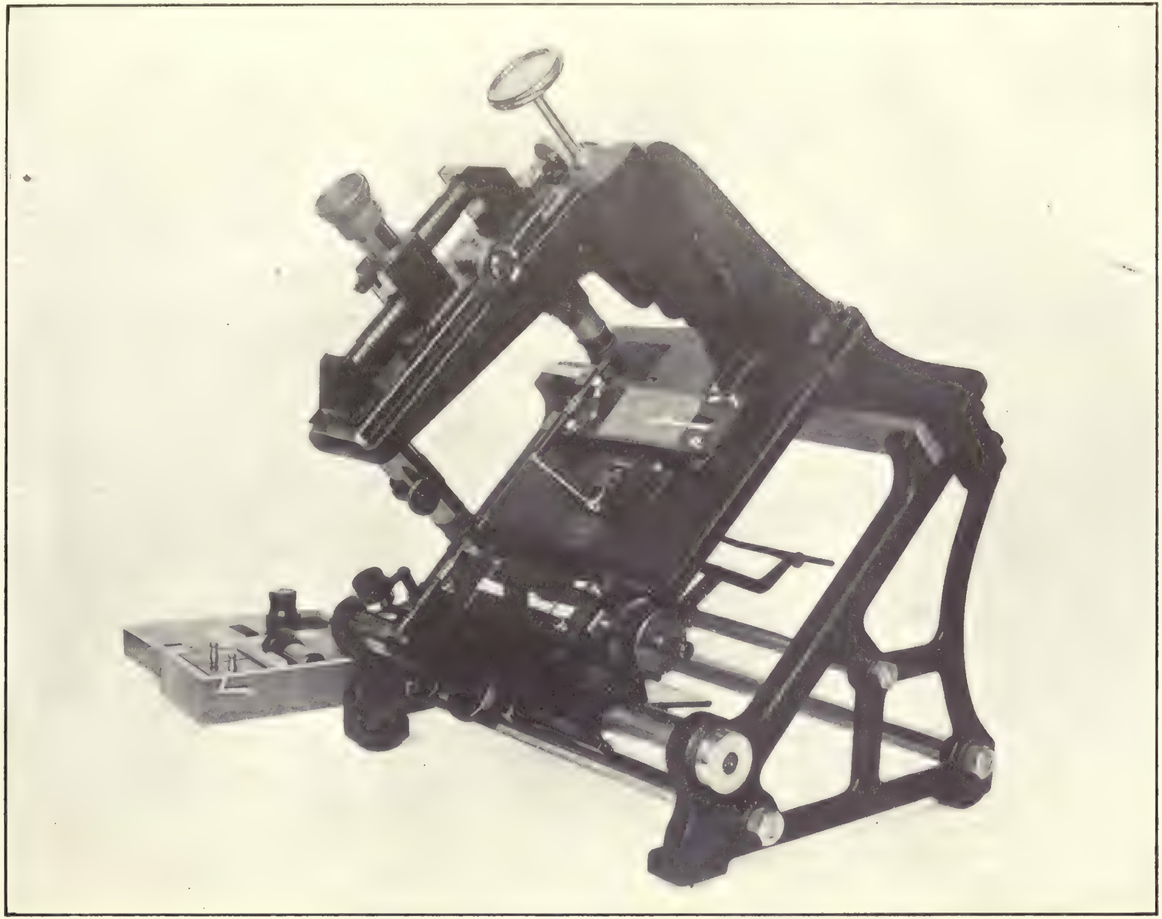


FIG. 9—Spectro-Comparator.

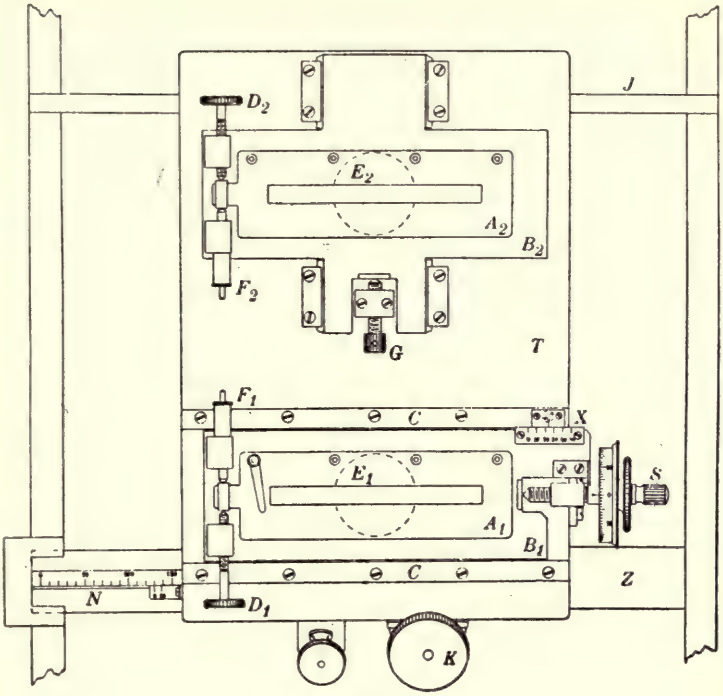

J
D_2
E_2
A_2
B_2
F_2
G
T
F_1
C
X
E_1
S
A_1
B_1
C
Z
N
D_1
K

FIG. 10.

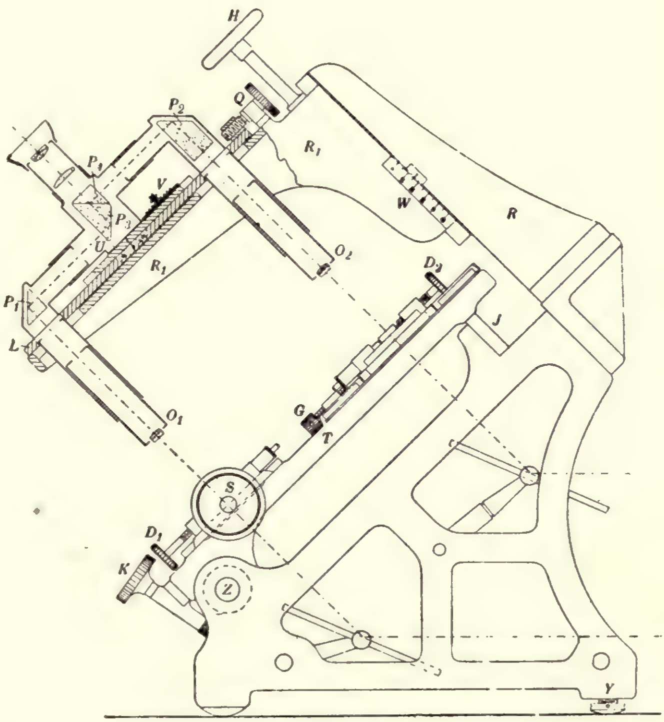

H
Q
P_2
R_1
V
W
R
P_3
U
R_1
O_2
D_2
P_1
J
L
G
O_1
T
S
D_1
K
Z
Y

FIG. 11.

star spectrum between and touching two strips of sun spectrum, and also on either side a narrow strip of the star comparison between and touching strips of sun comparison spectrum. The compound prism P_3 P_4, with the eyepiece, is carried on a slide U moved by rack and pinion V, so that the distance between the eyepiece and the objectives and consequently the magnification of the two spectra may be changed at will. This is to enable them, even though of different dispersions, to be made apparently identical in the field and hence readily and accurately comparable.

The adjustment of the spectra on the machine is a comparatively simple matter, only taking a few moments. The standard or fundamental solar spectrum usually made on a lantern or process plate in order to obtain sufficient contrast, is placed on its carriage, and clamped by a pair of spring microscope clamps. The carriage is then moved by the pinion K until the centre of rotation of the orienting arrangement is directly under the microscope 1, which is in this case at the reading 132·3 on the scale N.

The whole microscope system is now moved by the screw Q until the solar spectrum is centrally situated with respect to the central silver strip in the field. By moving the carriage back and forwards the spectrum can be rapidly oriented. The star spectrum may be similarly oriented while it is made central by the screw G. There then remains only to adjust the magnification of the separate spectra, the comparison lines of the two appear coincident in the whole extent of the field of view. By moving the ocular by the rack and pinion V, the magnification of one spectrum is increased and of the other decreased. This will evidently disturb the focus, but this can be easily corrected by adjusting the objectives O_1 and O_2 by their focussing screws seen in Fig. 9. This will again slightly change the magnification and the process may need to be repeated, but a little practice soon enables one to equalize the apparent dispersion very quickly.

Before making any measurements it is necessary to divide the fundamental solar spectrum into regions, indicated by small ink dots, and numbered for identification. These regions are so chosen that there is a slight overlapping of the field in adjacent regions with the magnification to be employed. The dots, which are brought under the wire in the measurement, are placed, as nearly as possible, in the centre of a group of good solar lines and at the same time so that the field includes a number of good comparison lines. The regions selected in a series of good fundamental solar spectra made on May 14, 1908, on Seed process plates are given in the following table. In addition in the third column of the table are given the velocities corresponding to one revolution of the micrometer screw. These velocities were computed from the measurement of lines on the fundamental spectrum by the micrometer screw of the comparator. These linear measurements were used to obtain the constants of the Hartmann formula, and from these constants the velocities corresponding to the wave length of each region were computed.

CONSTANTS OF FUNDAMENTAL SPECTRA, 1519-1526.

Exposed May 14, 1908.

No. of Region.	Wave Length.	Vel. per Rev. S.	No. of Region.	Wave Length.	Vel. per Rev. S.
1	4867·0	582·1	14	4374·5	364·2
2	4807·0	555·4	15	4346·5	352·1
3	4754·0	531·9	16	4322·8	341·8
4	4709·6	512·0	17	4298·2	331·1
5	4669·0	494·0	18	4273·3	320·4
6	4628·7	476·0	19	4249·9	310·4
7	4590·2	459·1	20	4226·8	300·6
8	4554·6	443·2	21	4206·0	291·7
9	4523·9	429·7	22	4184·3	282·1
10	4492·0	415·7	23	4157·2	271·2
11	4460·3	401·7	24	4139·5	263·4
12	4429·6	388·3	25	4117·8	255·7
13	4402·1	376·2	26	4099·0	246·7

$$\text{Log} f = \log. \frac{1}{2\,\Sigma\,\frac{1}{s}}$$

Region.	3	4	5	6	7
13			1·37646	1·42045	1·47137
14			1·32312	1·36175	1·40594
15		1·24332	1·27409	1·30846	1·34727
16	1·17577	1·20095	1·22877	1·25961	1·29412
17	1·13813	1·16116	1·18647	1·21436	1·24533
18	1·10239	1·12355	1·14671	1·17207	1·20008
19	1·06833	1·08786	1·10914	1·13236	1·15784
20	1·03576	1·05385	1·07349	1·09483	1·11815
21	1·00457	1·02139	1·03958	1·05928	1·08072
22	0·97452	0·99028	1·00710	1·02535	1·04514
23	0·94533	0·95996			
24	0·91718	0·93098			
25	0·88998	0·90283			
26	0·86348	0·87555			

The magnification of the two spectra may be varied between about 10 and 40 fold by means of two pairs of objectives and three oculars. Moreover, by suitably varying these the silver strips on the prism may be varied in apparent width to suit star spectra of different widths. It has been found that a magnification of about 20 seems to give better and easier measurements than either higher or lower powers, and it has generally been used, although tests have been made with different powers.

When the plates have been adjusted as described above, the line in the centre of the field is set on the dot towards the red end at which it is deemed advisable the measurement should begin. This is determined by the appearance of the star spectrum and of its comparison lines. It has not been generally taken lower down than No. 5 at wave length $\lambda 4669$, as below that the comparison spectrum is not so good and no gain in accuracy would result. Towards the violet end the measurement is carried until the star spectrum becomes too weak for accurate comparisons, frequently about dot 20, wave length $\lambda 4227$. However, in a well exposed star spectrum the measurement could be extended over the whole range on the plate from H_β to H_δ, although in my opinion nothing would be gained in accuracy by such procedure over that obtained by the use of a less number, say 12 or 15 regions. The measurement proceeds according to a regular scheme of alternation of star and comparison settings,

so that at each region there are two settings on the star and two on the comparison lines, one by forward and one by backward rotation of the screw in each case. As soon as the measurement is completed, both star and fundamental spectra are reversed on the machine to overcome personality in the settings and the same regions are again measured.

It has been my experience that the most difficult part of the measurement is the determination of the point of coincidence of star and fundamental spectrum. Although with solar type stars of a considerable range in type, there is so little difference in the lines as to cause no trouble, nevertheless there are frequently apparently accidental irregularities in some of the lines in a region which render it difficult to determine the exact point of coincidence. The field extends over a considerable angle, and the eye can only observe at the most two or three lines at a time. These may be brought into the best coincidence, while lines in another part of the field may be better suited by a slightly different setting, and the best average is sometimes troublesome to obtain. These irregularities are chiefly due, I think, to irregular deposition of the silver grains in the comparatively coarse structure of the fast plates, to local distortions of the photographic film, to possibly non-uniform intensity of the star spectrum throughout its width and to other causes of a similar nature rather than to constant differences in the spectrum of star and sun. Such differences can be noted in the case of some lines, but these seem to be few compared with the accidental deviations observed. This difficulty does not exist to so great an extent with regard to the emission lines. Provided the comparison spectra are of nearly the same intensity, coincidences can be easily, quickly, and accurately obtained. The accidental deviations observed in the apparent positions of star lines serve to explain the comparatively high residual sometimes obtained in the direct measurement of good lines in solar type spectra.

After the measurement is completed the reduction of the separate measures to velocities is a simple matter. The difference in the settings for coincidence between emission and absorption spectra, multiplied by the velocity per revolution at the region under consideration gives the velocity at once. These differences are, however, tabulated for both positions of the plate, and the mean of the two for each region multiplied by the velocity factor gives the velocity for the region, while the velocity for the plate is obtained from the mean of the regions.

This considers all the regions as of equal weight, whereas such is not the case. In some parts of the spectrum the lines are more numerous or of better quality, and moreover as the dispersion increases, as we go towards the violet, greater weight should be given. There are then two courses open, to give weights according to the quality of the regions, increasing these as we go towards the violet, or to give weights proportional to the dispersion. The latter method is much simpler, and should give practically the same values as the more complex method and better values than the simple mean. Moreover, Hartmann has developed a very simple method of obtaining the velocity from the differences. If we call the differences with red to right d_1 and with red to left d_2, then the mean $d = \frac{1}{2}(d_1 + d_2)$, which multiplied by the velocity factor s, gives velocity sd for the region. Its weight is proportional to $\frac{1}{s}$, and hence the weighted mean velocity can be very simply represented by $\frac{\Sigma d}{\Sigma \frac{1}{s}}$. As $d = \frac{1}{2}(d_1 + d_2)$ we can avoid taking the means of the differences by changing it to $\frac{\Sigma d_1 + \Sigma d_2}{2\,\Sigma \frac{1}{s}}$. If we take the velocity values per revolution of the fundamental spectrum and form the expressions $\log\left(\frac{1}{2\,\Sigma \frac{1}{s}}\right)$ between all the regions which are likely to be used, the only pro-

cedure necessary to obtain the weighted mean velocity is to add all the differences together and add to the logarithm of the sum the tabulated value of the above expression. To the velocity of which this sum is the logarithm, must be added the computed radial velocity of the sum when the spectrum was made, and we have the radial velocity of the star with respect to the earth, which reduced for diurnal and annual motion will give us the velocity with respect to the sun.

As mentioned previously, only a few plates of β Geminorum made with the three-prism spectrograph have been measured, principally as a test of the capabilities of the instrument. It can practically be used only with spectra of the second and third classes, those with numerous well defined lines, allied to the spectrum of the sun. Our single-prism spectrograph has been almost entirely employed on stars of early type spectra, which can not be economically or accurately measured with the spectro-comparator. However, work on some solar type spectroscopic binaries with a short-focus camera on the three-prism spectrograph is about to start, and for the measurement of such spectra the comparator is especially suited.

One spectrum of β Geminorum No. 1373, of only moderately good quality, was selected as a test plate and has been measured fifteen times with different fundamental spectra, different arrangements of objectives and oculars and with two different ocular prisms.

The measures and their summary given below enable an estimate of the accuracy obtainable in measurement to be formed. Further ten additional plates of β Geminorum have been measured with constant conditions in the comparator, which enables an estimate to be formed of the instrumental errors to be expected in the making of the spectra. These also with a summary are given below:—

β GEMINORUM 1373.

SOLAR STANDARD 1360.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
7	·053	·049	·052	24·84	−0·06
8	47	48	48	22·18	+2·60
9	53	54	53	24·01	+0·77
10	55	51	53	23·53	+1·25
11	60	51	55	23·87	+0·91
12	50	48	49	20·58	+4·20
13	64	57	61	25·07	−0·29
14	65	65	65	26·32	−1·54
15	64	60	62	24·68	+0·10
16	64	62	63	24·57	+0·21
17	67	66	66	25·34	−0·56
18	72	73	73	27·45	−2·67
19	78	69	73	27·01	−2·23
20	79	74	76	27·51	−2·73
21	70	73	72	25·56	−0·78
22	74	73	73	25·33	−0·55
23	71	68	70	23·94	+0·84
24	76	71	73	24·38	+0·40
25	71	75	73	23·80	+0·98
26	87	78	82	25·91	−1·13
27	84	76	80	24·48	+0·30
28	85	90	88	26·40	+1·62
29	91	91	91	26·57	+1·79
30	87	71	79	22·51	+2·26
31	89	90	89	24·03	+0·75
	1758	1683	Mean ..	.... +24·78	....

$\Sigma d = 3441$ log = ·53668
log f = ·85865
log (V_s-V_o) = 1·39533

$V_s - V_o = +\ 24{\cdot}85$ $r = \pm\ 1{\cdot}10$
$V_o = +\ 0{\cdot}21$
$V_a = -\ 21{\cdot}97$
$V_d = -\ 0{\cdot}16$ $V = +\ 2{\cdot}93$

β GEMINORUM 1373.

SOLAR STANDARD 1461.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
1	·049	·051	·050	24·90	−0·32
2	49	51	50	24·21	+0·37
3	48	47	48	22·61	+1·97
4	48	51	49	22·56	+2·02
5	50	55	53	23·84	+0·74
6	54	51	52	22·85	+1·73
7	52	53	53	22·76	+1·82
8	57	57	57	23·88	+0·70
9	59	63	61	24·99	−0·41
10	64	62	63	25·21	−0·62
11	66	65	65	25·43	−0·85
12	68	65	66	25·25	−0·67
13	70	67	69	25·87	−1·29
14	73	70	71	26·04	−1·46
15	64	70	67	24·05	+0·53
16	68	73	71	24·94	−0·36
17	72	72	72	24·80	−0·22
18	74	72	73	24·60	−0·02
19	75	74	74	24·43	+0·15
20	76	82	79	25·55	−0·97
21	82	80	81	25·62	−1·04
22	78	80	79	24·47	+0·11
23	85	84	84	25·48	−0·90
24	78	87	83	24·68	−0·10
25	93	82	88	25·55	−0·97
	1652	1658	Mean...	.... +24·58	....

$\Sigma d = 3310$

$\log = \cdot 51983$
$\log f = \cdot 87155$
$\log (V_s - V_o) = 1\cdot 39138$

$V_s - V_o = +\ 24\cdot 63$
$V_o = +\ 0\cdot 52$
$V_a = -\ 21\cdot 97$
$V_d = -\ 0\cdot 16$

$V = +\ 3\cdot 02$

$r = \pm\ 0\cdot 71$

β GEMINORUM 1373.

SOLAR STANDARD 1461.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·055	·051	·053	24·96	−1·06
4	45	52	48	22·10	+1·80
5	47	53	50	22·49	+1·41
6	50	47	49	21·53	+2·37
7	53	53	53	22·76	+1·14
8	49	51	50	20·95	+2·95
9	58	63	60	24·58	−0·68
10	64	62	63	25·21	−1·31
11	60	59	60	23·47	+0·43
12	65	61	63	24·10	−0·20
13	67	62	64	24·00	−0·10
14	68	72	70	25·68	−1·78
15	69	62	66	23·69	+0·21
16	79	65	72	25·29	−1·39
17	68	69	69	23·78	+0·12
18	68	76	72	24·26	−0·36
19	74	74	74	24·43	−0·53
20	74	72	73	23·61	+0·29
21	77	74	75	23·72	+0·18
22	78	79	78	24·16	−0·26
23	79	81	80	24·26	−0·36
24	88	83	86	25·57	−1·67
25	91	82	86	24·97	−0·07
	1526	1503	Mean..	....+23·90	....

$\Sigma d = 3029$ log = ·48130

log f = ·89871

log (Vs − Vo) = 1·38001 $r = \pm 0·81$

Vs-Vo = + 23·99

Vo = + 0·35

Va = − 21·97

Vd = − 0·16 V = + 2·23

β GEMINORUM 1373

SOLAR STANDARD 1462.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
4	·049	·049	·049	22·56	+2·12
5	52	51	51	22·94	+1·44
6	53	54	54	23.73	+0·65
7	60	57	58	24·91	−0·53
8	53	52	53	22·21	+2·16
9	64	57	60	24·58	−0·20
10	65	61	63	25·21	−0·83
11	67	64	66	25·82	−1·44
12	63	67	65	24·87	−0·49
13	68	69	68	25·50	−1·12
14	73	70	72	26·41	−2·03
15	67	64	65	23·34	+1·04
16	67	67	67	23·54	+0·84
17	68	73	71	24·47	−0·09
18	73	71	72	24·26	+0·12
19	69	70	69	22·78	+1·60
20	76	74	75	24·26	+0·12
21	83	83	83	26·25	−1·87
22	78	84	81	25·09	−0·71
23	79	79	79	23·96	+0·42
24	81	82	81	24·08	+0·30
25	89	87	88	25·59	−1·21
	1497	1485	Mean.	....+24·38	....

$\Sigma d = 2992$

log = ·47451
log f = ·91356
Log (V_s-V_o) = 1·38807

V_s-V_o = + 24·44
V_o = + 0·54
V_a = − 21·97
V_d = − 0·16

V = + 2·85

$r = \pm$ 0·81

β GEMINORUM 1373.

SOLAR STANDARD 1462.

Observer }
Measurer } J. S. P.

Region.	d_1	d_2	d	V	v
1	·052	·051	·051	25·40	−0·72
2	48	49	49	23·72	+0·96
3	55	50	52	24·50	+0·18
4	47	47	47	21·64	+3·04
5	50	54	52	23·39	+1·29
6	52	51	52	22·85	+1·83
7	60	54	57	24·48	+0·20
8	58	57	57	23·88	+0·80
9	61	62	62	25·40	−0·72
10	65	62	63	25·21	−0·53
11	64	61	63	24·65	+0·03
12	73	70	71	27·16	−2·48
13	74	66	70	26·25	−1·57
14	67	69	68	24·94	−0·26
15	65	67	66	23·69	+0·99
16	72	67	70	24·58	+0·10
17	70	69	69	23·77	+0·93
18	72	72	72	24·26	+0·42
19	74	74	74	24·43	+0·25
20	78	76	77	24·90	−0·22
21	84	79	81	25·62	−0·94
22	82	82	82	25·40	−0·72
23	83	79	81	24·57	+0·11
24	82	81	82	24·38	+0·30
25	94	87	90	26·13	−1·45
	1682	1636	Mean..	.... +24·68	....

$\Sigma d = 3318$ $\qquad$ $\log = \cdot 52088$

$\log f = \cdot 87155$

$\log (V_s - V_o) = 1\cdot 39243$

$V_s - V_o = +\ 24\cdot 68$ $\qquad$ $r = \pm\ 0\cdot 77$

$V_o = +\ 0\cdot 48$

$V_a = -\ 21\cdot 97$

$V_d = -\ 0\cdot 16$ $\qquad$ $V = +\ 3\cdot 03$

β GEMINORUM 1373.

SOLAR STANDARD 1462.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·053	·049	·051	24·03	+0·73
4	46	51	49	22·56	+2·20
5	55	52	53	23·84	+0·92
6	56	54	55	24·17	+0·59
7	47	55	51	21·90	+2·86
8	54	60	57	23·88	+0·88
9	62	61	61	24·99	−0·23
10	58	67	63	25·21	−0·45
11	59	68	63	24·65	+0·11
12	69	68	69	26·40	−1·64
13	72	67	69	25·87	−1·11
14	68	65	67	24·58	+0·18
15	70	64	67	24·05	+0·71
16	72	71	72	25·29	−0·53
17	72	74	73	25·15	−0·39
18	72	71	72	24·26	+0·50
19	78	77	77	25·42	−0·66
20	80	82	81	26·19	−1·43
21	85	80	82	25·94	−1·18
22	83	81	82	25·40	−0·64
23	88	85	86	26·08	−1·32
24	89	91	90	26·76	−2·00
25	89	84	85	25·26	−0·50
	1577	1577	Mean..	.... +24·76	... .

$\Sigma d = 3154$ log = ·49886

log f = ·89871

log (V_s−V_o) = 1·39757

$V_s - V_o = +\ 24{\cdot}98$ $r = \pm\ 0{\cdot}79$

$V_o = +\ 0{\cdot}33$

$V_a = -\ 21{\cdot}97$

$V_d = -\ 0{\cdot}16$ $V = +\ 3{\cdot}18$

β GEMINORUM 1373.

SOLAR STANDARD 1462.

Observer, Measurer } J. S. P.

Region.	d_1	d_2	d	V	v
1	·049	·047	·048	23·91	+0·27
2	44	51	48	23·24	+0 94
3	50	51	50	23·55	+0·63
4	50	45	48	22·10	+2·08
5	53	51	52	23·39	+ ·79
6	54	56	55	24·17	+ ·01
7	60	59	60	25·76	−1·58
8	56	58	57	23·88	+ ·30
9	57	59	58	23·76	+ ·42
10	59	60	60	24·01	+ ·17
11	59	64	61	23·86	+ ·32
12	60	66	63	24·10	+ ·08
13	65	65	65	24·37	− ·19
14	66	68	67	24·58	− ·40
15	68	68	68	24·41	− ·23
16	60	64	62	21·77	+2·41
17	70	75	72	24·80	− ·62
18	70	77	74	24·94	− ·76
19	74	72	73	24·10	+ ·08
20	76	75	76	24·58	− ·40
21	82	74	78	24·67	− ·49
22	85	78	81	25·09	− ·91
23	85	78	82	24·87	− ·69
24	88	82	85	25·27	−1·09
25	89	90	89	25·84	−1·66
26	78	95	87	24·84	− ·66
	1707	1728	Mean..	....+24·18	....

$\Sigma d = 3435$

log = ·53618
log f = ·84949
log (Vs−Vo) = 1·38567

Vs−Vo = + 24·30
Vo = + 0·33
Va = − 21·97
Vd = − 0·16

V = + 2·50

$r = \pm\ 0{\cdot}63$

β GEMINORUM 1373.

SOLAR STANDARD 1462.

High Power Objective.
Low Power Ocular.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·053	·050	·051	24·03	+0·28
4	50	47	49	22·56	+1·75
5	53	50	51	22·94	+1·37
6	60	51	56	24·61	−0·30
7	57	53	55	23·62	+0·69
8	58	53	55	23·04	+1·27
9	59	57	58	23·76	+0·55
10	59	62	61	24·41	−0·10
11	63	65	64	25·04	−0·73
12	66	73	69	26·40	−2·09
13	73	69	71	26·62	−2·31
14	73	64	69	25·31	−1·00
15	69	65	67	24·05	+0·26
16	71	66	68	23·88	+0·43
17	66	69	68	23·43	+0·88
18	72	70	71	23·93	+0·38
19	73	66	70	23·11	+1·20
20	75	77	76	24·58	−0·27
21	81	73	77	24·35	+0·04
22	87	74	80	24·78	−0·47
23	80	73	77	23·35	+0·96
24	86	83	84	24·97	−0·66
25	97	85	91	26·42	2·11
	1575	1495	Mean...	.... +24·31	....

Σd = 3070

log = ·48714
log f = ·89871
log (V_s—V_o) = 1·38585

r = ± 0·74

V_s—V_o = + 24·32
V_o = + 0·33
V_a = − 21·97
V_d = − 0·16

V = + 2·52

β GEMINORUM 1373.

SOLAR STANDARD 1465.

Observer. Measurer. } J. S. P.

Region.	d_1	d_2	d	V	v
3	·051	·055	·053	24·96	−0·90
4	48	50	49	22·56	+1·50
5	47	45	46	20·69	+3·37
6	48	51	49	21·53	+2·53
7	51	57	54	23·19	+0.87
8	51	48	50	20·95	+3·11
9	61	64	62	25·40	−1·34
10	63	57	60	24·01	+0·05
11	66	65	66	25·82	−1·76
12	68	67	67	25·63	−1·57
13	67	63	65	24·37	−0·31
14	71	63	67	24·58	−0·52
15	72	65	69	24·77	−0·71
16	65	66	65	22·83	+1·23
17	72	68	70	24·12	−0·06
18	69	70	70	23·59	+0·47
19	72	70	71	23·43	+0·63
20	75	75	75	24·25	−0·19
21	82	76	79	24·99	−0·93
22	83	82	82	25·39	−1·33
23	85	77	81	24·57	−0·51
24	89	84	87	25·87	−1·81
25	88	90	89	25·84	−1·78
	1544	1508	Mean...	....+24·06	....

$\Sigma d = 3052$

$\log = \cdot 48458$

$\log f = 89871$

$\log (V_s - V_o) = 1 \cdot 38329$

$V_s - V_o = + 24 \cdot 17$

$V_o = + 0 \cdot 27$

$V_a = - 21 \cdot 97$

$V_d = - 0 \cdot 16$

$V = + 2 \cdot 31$

$r = \pm 1 \cdot 02$

β GEMINORUM 1373.

SOLAR STANDARD 1468.

Observer / Measurer } J. S. P.

Region.	d_1	d_2	d	V	v
3	·054	·056	·055	25·91	−1·74
4	50	54	52	23·94	+0·23
5	49	50	50	22·94	+1·68
6	53	51	52	22·85	+1·32
7	55	56	55	23·62	+0·55
8	57	48	53	22·21	+1·96
9	57	61	59	24·17	0·00
10	65	66	65	26·01	−1·84
11	58	56	57	22·30	+1·87
12	66	64	65	24·87	−0·70
13	72	66	69	25·87	−1·70
14	72	67	69	25·31	−1·14
15	69	68	69	24·77	−0·60
16	72	68	70	24·58	0·41
17	67	63	65	22·39	+1·78
18	75	67	71	23·93	+0·24
19	73	70	71	23·44	+0·73
20	75	75	75	24·25	−0·08
21	80	82	81	25·62	−1·45
22	77	80	79	24·47	−0·30
23	75	79	77	23·35	+0·82
24	81	82	82	24·38	−0·21
25	86	89	87	25·26	−1·09
	1538	1518	Mean...	.... +24·17	....

$\Sigma d = 3056$ log = ·48515

log f = ·89871

Log (Vs-Vo) = 1·38386

Vs-Vo = + 24·20 $r = \pm$ 0·80

Vo = + 0·23

Va = − 21·97

Vd = − 0·16 V = + 2·30

β GEMINORUM 1373.

SOLAR STANDARD 1517.

High Power. Observer, Measurer } J. S. P.

Region.	d_1	d_2	d	V	v
4	·047	·046	·046	21·18	+2·79
5	45	50	48	21·59	+2·28
6	52	53	52	22·85	+1·12
7	55	56	55	23·62	+0·35
8	52	51	52	21·79	+2·18
9	59	60	59	24·17	−0·20
10	61	66	64	25·61	−1·64
11	62	62	62	24·25	−0·28
12	61	63	62	23·72	+0·25
13	63	66	64	24·00	−0·03
14	70	66	68	24·94	−0·97
15	66	70	68	24·41	−0·44
16	68	68	68	23·88	+0·09
17	72	68	70	24·12	−0·15
18	71	73	72	24·26	−0·29
19	73	71	72	23·77	+0·20
20	79	75	77	24·90	−0·93
21	77	85	81	25·62	−1·65
22	80	82	81	25·09	−1·12
23	78	84	81	24·57	−0·60
24	81	80	81	24·08	−0·11
25	87	86	86	24·97	−1·00
	1459	1481	Mean...	....+23·97	....

$\Sigma d = 2940$

log = ·46835

log f = ·91360

log (V_s−V_o) = 1·38195

$V_s - V_o = +\ 24{\cdot}10$

$V_o = +\ 0{\cdot}54$

$V_a = -\ 21{\cdot}97$

$V_d = -\ 0{\cdot}16$

$r = \pm\ 0{\cdot}79$

$V = +\ 2{\cdot}51$

β GEMINORUM 1373.

SOLAR STANDARD 1519.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
5	·047	·048	·048	23·71	+0·94
6	49	52	50	23·80	+0·85
7	50	54	52	23·87	+0·78
8	51	53	52	23·05	+1·60
9	53	54	54	23·20	+1·45
10	55	56	55	22·86	+1·79
11	61	59	60	24·10	+0·55
12	63	65	64	24·85	−0·20
13	68	70	69	25·96	−1·31
14	72	69	71	25·86	−1·21
15	69	72	70	24·65	0·00
16	76	72	74	25·29	−0·64
17	81	75	78	25·87	−1·16
18	77	79	78	24·99	−0·34
19	83	81	82	25·45	−0·80
20	86	84	85	25·55	−0·90
21	92	85	89	25·96	−1·31
	1133	1128	Mean...	....+24·65	

$\Sigma d = 2261$

$\log = \cdot 35430$

$\log f = 1 \cdot 03958$

$\log (V_s - V_o) = 1 \cdot 39388$

$V_s - V_o = + 24 \cdot 77$ $\qquad r = \pm 0 \cdot 72$

$V_o = + 0 \cdot 41$

$V_a = - 21 \cdot 97$

$V_d = - 0 \cdot 16$ $\qquad V = +3 \cdot 05$

β GEMINORUM 1373.

SOLAR STANDARD 1520.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
5	·046	·048	·047	23·22	+1·70
6	53	51	52	24·75	+0·17
7	50	51	51	23·41	+1·61
8	59	57	58	25·71	−0·79
9	57	60	58	24·92	0·00
10	59	55	57	23·69	+1·23
11	64	64	64	25·71	−0·79
12	68	68	68	26·40	−1·48
13	72	70	71	26·71	−1·79
14	67	72	70	25·49	−0·57
15	68	72	70	24·65	+0·27
16	73	69	71	24·27	+0·65
17	73	73	73	24·17	+0·75
18	78	81	80	25·63	−0·71
19	83	81	82	25·45	−0·53
20	79	83	81	24·35	+0·57
21	88	84	86	25·09	−0·17
	1147	1139	Mean...	....+24·92	....

$\Sigma d = 2286$ log = ·35908

log f = 1·03958

log (V_s-V_o) = 1·39866

V_s-V_o = + 25·04 $r = \pm 0·65$

V_o = + 0·38

V_a = − 21·97

V_d = − 0·16 V = + 3·29

β GEMINORUM 1373

SOLAR STANDARD 1524.

Observer. }
Measurer. } J. S. P.

Region.	d_1	d_2	d	V	v
5	·050	·049	·049	24·21	+0·02
6	49	48	49	23·32	+0·91
7	47	47	47	21·57	+2·66
8	52	49	51	22·60	+1·63
9	58	53	55	23.63	+0·60
10	62	53	58	24·11	+0·12
11	64	63	63	25·31	−1·08
12	63	63	63	24·46	−0.23
13	69	70	70	26·33	−2·10
14	68	73	70	25·49	−1·27
15	62	66	64	22·53	+1·70
16	67	72	70	23·93	+0·30
17	72	79	75	24·83	+0·60
18	72	76	74	23·71	+0 52
19	83	83	83	25·76	−1·53
20	82	82	82	24·65	−0·42
21	89	84	87	25·38	−1·15
	1109	1110	Mean...	...+24·23	....

$\Sigma d = 2219$

log = ·34616
$\log f = 1·03958$
$\log (V_s - V_o) = 1·38574$

$V_s - V_o = + 24·31$
$V_o = + 0.23$
$V_a = - 21·97$
$V_d = - 0·16$

$V = + 2·41$

$r = \pm 0·84$

β GEMINORUM 1306.

Observer. Measurer. } J. S. P.

Region.	d_1	d_2	d	V	v
3	·023	·020	·021	9·89	+0·47
4	22	22	22	10·13	+0·23
5	19	18	19	8·55	+1·83
6	24	21	23	10·11	+0·25
7	28	25	26	11·16	−0·80
8	25	23	24	10·06	+0·30
9	26	28	27	11·06	−0·70
10	22	24	23	9·20	+1·16
11	32	26	29	11·34	−0·98
12	28	24	26	9·95	+0·41
13	30	21	26	9·75	+0·61
14	26	30	28	10·27	+0·09
15	30	38	34	12·21	−1·85
16	26	26	26	9·13	+1·23
17	29	36	32	11·02	−0·66
18	27	25	26	8·76	+1·60
19	36	24	30	9·90	+0·46
20	38	31	35	11·32	−0·96
21	37	28	32	10·12	+0·24
22	36	32	34	10·53	−0·17
23	41	35	38	11·53	−1·17
24	40	37	39	11·59	−1·23
25	38	36	37	10·74	−0·38
	683	630	Mean...	....+10·36	....

$\Sigma d = 1313$

log = ·11826
log f = ·89871
log (V_s-V_o) = 1·01697

$V_s - V_o = + 10{\cdot}40$
$V_o = + 0{\cdot}33$
$V_a = - 8{\cdot}67$
$V_d = - 0{\cdot}22$

$r = \pm 0{\cdot}63$

$V = + 1{\cdot}84$

β GEMINORUM 1417.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·061	·058	·059	27·79	+0·80
4	65	65	65	29·93	−1·34
5	59	58	59	26·54	+2·05
6	66	64	65	28·56	+0·03
7	67	65	66	28·34	+0·25
8	65	64	65	27·24	+1·35
9	74	69	71	29·08	−0·49
10	73	77	75	30·01	−1·42
11	75	76	76	29·73	−1·14
12	77	76	76	29·08	−0·49
13	78	75	77	28·87	−0·28
14	82	74	78	28·61	−0·02
15	78	79	78	28·00	+0·59
16	80	76	78	27·39	+1·20
17	79	77	78	26·87	+1·72
18	83	84	84	28·31	+0·28
19	85	85	85	28·06	+0·53
20	91	87	89	28·78	−0·19
21	96	96	96	30·36	−1·77
22	96	96	96	29·73	−1·14
23	92	94	93	28·21	+0·38
24	94	100	97	28·84	−0 25
25	105	98	101	29·32	−0·73
	1821	1793	Mean...	.... +28·59	....

$\Sigma d = 3615$ log = ·55811

log f = ·89871

log (Vs−Vo) = 1·45682

$r = \pm 0·68$

Vs−Vo = + 28·63

Vo = + 0·33

Va = − 27·36

Vd = − 0·19

V = + 1·41

β GEMINORUM 1424.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·063	·060	·062	29·21	−0·07
4	61	61	61	28·08	+1·06
5	62	63	62	27·89	+1·25
6	66	63	65	28·56	+0·58
7	65	66	65	27·91	+1·23
8	62	60	61	25·56	+3·58
9	68	71	69	28·26	+1·88
10	72	74	73	29·21	−0·07
11	74	70	72	28·17	+0·97
12	70	82	76	29·08	+0·06
13	73	82	78	29·25	−0·11
14	78	83	80	29·34	−0·20
15	77	83	80	28·72	+0·42
16	83	85	84	29·50	−0·36
17	89	91	90	31·00	−1·86
18	94	93	93	31·34	−2·20
19	87	93	90	29·70	−0·56
20	92	96	94	30·40	−1·26
21	90	94	92	29·10	+0·04
22	97	98	98	30·35	−1·21
23	90	96	93	28·21	+0·93
24	101	107	104	30·92	−1·78
25	106	103	105	30·48	−1·34
	1820	1874	Mean..	...+ 29·14	....

Σd = 3694

log = ·56750
log f = ·89871
log (Vs–Vo) = 1·46621

r = ± 0·88

Vs–Vo = + 29·26
Vo = + 0·33
Va = − 27·89
Vd = − 0·12

V = + 1·58

β GEMINORUM 1443.

Observer / Measurer } J. S. P.

Region.	d_1	d_2	d	V	v
3	·061	·060	·061	28·76	+2·80
4	66	67	66	30·39	+1·17
5	66	65	66	29·69	+1·87
6	66	67	66	29·00	+2·56
7	68	75	72	30·92	+0·64
8	74	78	76	31·84	−0·28
9	80	77	78	31·95	−0·39
10	78	80	79	31·62	−0·06
11	79	83	81	31·69	−0·13
12	86	87	87	33·29	−1·73
13	87	82	84	31 50	+0·06
14	86	86	86	32·64	−1·08
15	85	88	87	31·23	+0.33
16	92	83	88	30·91	+0·65
17	93	94	93	32·05	−0·49
18	95	95	95	32·01	−0·45
19	92	94	93	30·70	+0·86
20	100	99	100	32·34	−0·78
21	104	96	100	31·63	−0·07
22	107	103	105	32·52	−0·96
23	108	106	107	32·45	−0·89
24	114	108	111	33·00	−1·44
25	118	114	116	33·67	−2·11
	2005	1987	Mean...	...+31·56	

$\Sigma d = 3992$ log = ·60119

log f = ·89871

log(Vs–Vo) = ·49990

Vs–Vo = + 31·62 $r = \pm 0·84$

Vo = + 0·33

Va = − 28·83

Vd = − 0·09 V = + 3·03

β GEMINORUM 1452.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·065	·062	·063	29·21	+1·43
4	65	62	64	29·47	+1·17
5	66	65	65	29·24	+1·40
6	65	72	69	30·32	+0·32
7	74	68	71	30·49	+0·15
8	73	69	71	29·75	+0·89
9	70	78	74	30·31	+0·33
10	80	76	78	31·22	−0·58
11	79	72	76	29·73	+0·91
12	84	79	81	30·99	−0·35
13	88	87	88	33·37	−2·73
14	85	79	82	30·08	+0·56
15	88	95	91	32·67	−2·03
16	88	92	90	31·61	−0·97
17	93	87	90	31·00	−0·36
18	89	94	92	31·00	−0·36
19	93	89	91	30·04	+0·60
20	87	89	88	28·78	+1·88
21	98	98	98	31·00	−0·36
22	99	97	98	30·35	+0·29
23	99	105	102	30·94	−0·30
24	105	106	105	31·22	−0·58
25	108	111	110	31·93	−1·29
	1941	1932	Mean.......	+30·64	....

$\Sigma d = 3873$

$\log = \cdot58805$
$\log f = \cdot89871$
$\log (V_s - V_o) = 1\cdot48676$

$r = \pm\ 0\cdot74$

$V_s - V_o = +\ 30\cdot67$
$V_o = +\ 0\cdot33$
$V_a = -\ 29\cdot19$
$V_d = -\ 0\cdot11$

$V = +\ 1\cdot70$

β GEMINORUM 1460.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·065	.064	·064	30·15	+1·91
4	68	63	66	30 39	+1·67
5	66	70	68	30·59	+1·47
6	66	66	66	29·00	+3·06
7	68	70	69	29·63	+2·43
8	70	71	71	29·75	+2·31
9	76	80	78	31·95	+0·11
10	83	82	82	32·82	−0·76
11	85	83	84	32·86	−0·80
12	86	82	84	32·14	−0·08
13	90	83	87	32·62	−0·56
14	93	89	91	33·38	−1·32
15	94	88	92	33·03	−0·97
16	93	89	91	31·96	+0·10
17	101	97	99	34 11	−2·05
18	92	92	92	31·00	+1·06
19	95	100	98	32·35	−0·29
20	102	105	103	33·31	−1·25
21	102	105	104	32·90	−0·84
22	102	108	105	32·52	−0·46
23	107	104	105	31·85	+0·21
24	117	119	118	35·08	−3·02
25	113	121	117	33·96	−1·90
	2034	2031	Mean...	.... +32·06	....

Σd = 4065

log = ·60906
log f = ·89871
log (Vs−Vo) = ·50777

Vs−Vo = + 32·19
Vo = + 0·33
Va = − 29·24
Vd = − 0·09

r = ± 1·14

V = + 3·19

β GEMINORUM 1472.

SOLAR STANDARD 1520.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
5	·053	·056	·055	27·17	+3 94
6	61	63	62	29·51	+1·60
7	71	69	70	32·14	−1·03
8	67	67	67	29·69	+1·42
9	70	73	71	30·51	+0·60
10	73	73	73	30·35	+0·76
11	76	77	77	30·93	+0·18
12	77	80	78	30·29	+0·82
13	83	86	85	31·98	−0·87
14	89	87	88	32·41	−1·30
15	88	92	90	31·69	−0·58
16	95	93	94	32·13	−1·02
17	96	97	96	31·81	−0·70
18	100	103	102	32·68	−1·57
19	104	102	103	31·97	−0·86
20	104	103	104	31·26	−0·15
21	115	108	111	32·38	−1·27
	1422	1429	Mean...	....+31·11	.. ..

$\Sigma d = 2851$ log = ·45500

log f = 1·03958

log (Vs−Vo) = 1·49458

Vs−Vo = + 31·23 $r = \pm$ 0·94

Vo = + 0·38

Va = − 29·41

Vd = − 0·21 V = + 1·99

β GEMINORUM 1500.

SOLAR STANDARD 1519.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
5	·061	·064	·062	30·63	+0·20
6	66	66	66	31·42	−0·59
7	64	64	64	29·38	+1·45
8	61	66	64	28·36	+2·47
9	73	69	71	30·51	+0·32
10	69	70	70	29·10	+1·73
11	77	78	77	30·93	−0·10
12	79	77	78	30·29	+0·54
13	86	78	82	30·85	−0·02
14	91	89	90	32·77	−1·94
15	87	80	84	29·58	+1·25
16	92	88	90	30·76	+0·07
17	100	92	96	31·79	−0·96
18	98	102	100	32·04	−1·21
19	104	106	105	32·59	−1·76
20	106	103	105	31·56	−0·73
21	112	104	108	31·50	−0·67
	1426	1396	Mean...	......30·83	....

$\Sigma d = 2822$ log= ·45056
log f= 1·03958
log (Vs—Vo)= 1·49014

$r = \pm 0·81$

Vs—Vo= + 30·91
Vo= + 0·41
Va= − 29 14
Vd= − 0·15

V = + 2·03

β GEMINORUM 1502

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·059	·065	·062	29·21	+1·98
4	69	62	65	29·93	+1·26
5	65	65	65	29·24	+1·95
6	64	70	67	29·44	+1·75
7	67	68	68	29·20	+1·99
8	73	71	72	30·17	+1·02
9	82	76	79	32·36	−1·17
10	83	81	82	32·82	−1·63
11	79	80	80	31·30	−0·13
12	85	90	87	33 29	−2·10
13	89	87	88	33·00	−1·81
14	80	86	83	30·44	+0·75
15	88	88	88	31·59	−0·40
16	90	85	88	30·91	+0·28
17	89	91	90	31·02	+0·17
18	89	91	90	30·33	+0·86
19	99	100	99	32·68	−1·49
20	100	100	100	32·34	−1·15
21	98	100	99	31·31	−0·12
22	108	102	105	32·32	−1·13
23	101	93	97	29·42	+1·77
24	108	114	111	33 00	−1·81
25	110	113	111	32·22	−1·03
	1975	1978	Mean...	.... +31·19	

$\Sigma d = 3953$

log = ·59693
log f = ·89871
log (Vs − Vo) = 1·49564

Vs − Vo = + 31·31
Vo = + 0·33
Va = − 29·09
Vd = − 0·12

$r = \pm 0·93$

V = + 2·43

β GEMINORUM 1527.

SOLAR STANDARD 1520.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
5	·047	·053	·050	24·70	+2·16
6	51	52	52	24·75	+2·11
7	55	58	56	25·71	+1·15
8	62	61	62	27·48	−0·62
9	58	64	61	26·21	+0·65
10	60	64	62	25·77	+1·09
11	69	65	67	26·91	−0·05
12	66	72	69	26·79	+0·07
13	74	73	73	27·46	−0·60
14	75	79	77	28·04	−1·18
15	83	74	79	27·82	−0·96
16	85	82	83	28·37	−1·51
17	86	82	84	27·81	−0·95
18	87	79	83	26·59	+0·27
19	93	90	91	28·25	−1·39
20	90	90	90	27·05	−0·19
	1141	1138	Mean...	....+26·86	....

$\Sigma d = 2279$ $\log = \cdot 35774$
$\log f = 1\cdot 07349$
$\log (V_s - V_o) = 1\cdot 43123$

$V_s - V_o = + 26\cdot 99$ $r = \pm 0\cdot 77$
$V_o = + 0\cdot 38$
$V_a = - 24\cdot 85$
$V_d = - 0\cdot 24$ $V = + 2\cdot 37$

SUMMARY OF COMPARATOR MEASURES OF β GEMINORUM 1373.

Solar Standard.	No. of Regions.	Velocity.	Residual O − C.	Probable error of Single Region.
1360	25	+2·93	−0·21	±1·10
1461	25	+3·02	−0·31	0·71
1461	23	+2·23	+0·49	0·81
1462	22	+2·85	−0·13	0·81
1462	25	+3·03	−0·31	0·77
1462	23	+3·18	−0·46	0·79
1462	26	+2·50	+0·22	0·63
1462	23	+2·52	+0·20	0·74
1465	23	+2·31	+0·41	1·02
1468	23	+2·30	+0·42	0·80
1517	22	+2·51	+0·21	0·79
1519	17	+3·05	−0·33	0·72
1520	17	+3·29	−0·57	0·65
1524	17	+2·41	+0·31	0·84

Mean velocity + 2·72.   Mean P. E. ± 0·80.

Probable error of single measure = ± 0·24km.
Probable error of mean velocity = ± 0·065km.

SUMMARY OF MEASURES OF 11 PLATES OF β GEMINORUM.

Plate No.	No. of Regions.	Velocity.	Residual.	Probable error of Single Region.
1306	23	+1·84	+0·37	±0·63
1373	..	2·72	−0·51	0·80
1417	23	1·41	+0·80	0·68
1424	23	1·58	+0·63	0·88
1443	23	3·03	−0·82	0·84
1452	23	1·70	+0·51	0·74
1460	23	3·19	−0·98	1·14
1472	17	1·99	+0·22	0·94
1500	17	2·03	+0·18	0·81
1502	23	2·43	−0·22	0·93
1527	16	2·37	−0·16	0·77

Mean velocity + 2·21. Mean P. E. ± 0·83.

Probable error of plate = ± 0·40.
Probable error of mean = ± 0·12.

As the summaries and probable errors above show, the error of setting on a single region is on the average in the several measures of the plate No. 1373 ± 0·80km., and only slightly greater ± 0·83 for the other plates. Hartmann obtained a probable error of ± 0·67km., somewhat smaller than above. The difference may be due partly to his greater skill and experience in measurement and partly possibly to better quality of spectra. If a better spectrum than 1373 had been selected and it were measured with the best of the fundamental spectra, I have no doubt the probable error would be considerably diminished.

The measures of the 11 plates of β Geminorum give an indication of the systematic discrepancies to be expected in the production of the spectra, although some allowance should be made for accidental errors of measurement. A total range of nearly 1·8km. is shown and the probable error of a plate is ± 0·40km. These plates were made under average conditions, no special care being taken, and the plates are of average quality only. A systematic difference between these measures and other determinations by the old method of measurement at this, and other observatories of slightly over a kilometre + 3·5km. with micrometer microscope, + 2·2km. with comparator is present. These plates have only been measured by the comparator, and hence it cannot be determined yet whether this difference is in the plates or in the method of measurement, but the latter seems the more probable. It is interesting to note in this connection that there is a gradual and systematic increase in the velocity of the different regions from the red to the violet in all the star plates measured, but no explanation of the cause of this discrepancy can be offered. It is unquestionable that if this were removed the probable error of a single region would be materially reduced. Finally, it is probable that, as more experience is gained with the instrument, the accuracy of the measures will be considerably increased.

THE COELOSTAT TELESCOPE.

Although the optical and mechanical parts of this instrument have been ready for nearly two years, the shelter and connecting passage and tunnel were not finally completed until about July, 1908, and it was not possible to make any use of the installation until some time after that date. The spectrograph, which is described by Dr. DeLury in Appendix C, was erected and adjusted as soon after as possible, but owing to the inferior quality of the grating, the work has been much handicapped.

The telescope itself performs admirably and as it has not yet been described, it seems desirable to mention here its principal features.

Essentially the optical parts of the installation consist of the coelostat mirror, which reflects the sun's light in a southerly direction to a secondary plane mirror, which in turn reflects the beam north to a concave mirror forming a solar image 80 feet south in the basement of the observatory building.

A general view of the coelostat and secondary mirror, and of the shelters and connecting passages for the beam is given in Fig. 13. The coelostat and secondary mirror are covered by a house on wheels, which can be easily rolled back (and is thus shown in the figure) by a convenient mechanism over the louvred passageway which contains the concave mirror. Between the latter and the basement of the Observatory is another ventilated passage and a tunnel. The house and passages are constructed of wood, covered with galvanized iron painted white, and all very thoroughly ventilated by galvanized iron louvres to prevent as far as possible temperature stratification or disturbance in the course of the beam. It would have been preferable to continue the ventilated passage along the whole course of the beam from the coelostat to the Observatory wall, but this was not possible on account of the necessity of a driveway. This difficulty was overcome by making a tunnel for the last 20 feet, or so, through which the beam passes to the focus. As the latter is usually five feet or so outside the wall, this leaves an unventilated distance of about 15 feet, which apparently has no very serious effect on the definition.

A general view of the telescope looking north is given in Fig. 14, and another view looking south towards the Observatory in Fig. 15. The coelostat has a plane mirror 20 inches in diameter which rotates on an axis, in or parallel to its plane, which is parallel to the axis of the earth and driven by clockwork at half the diurnal rate. The whole instrument is moved bodily east and west by the sheave and cable, shown in the figures, on cast-iron ways resting on a cement pier. The purpose of this movement is to enable the coelostat mirror to receive the sun light more nearly normally by placing it towards the west in the morning and the east in the afternoon. The ways are long enough to permit of sufficient movement to prevent any interception of the return beam from the concave, which passes under the secondary mirror.

The beam of sunlight from the coelostat mirror is reflected in a constant direction so long as the declination remains the same, but evidently any change in the declination of the incident light entails a similar change in the direction of the reflected light, and it is necessary to have a movable secondary mirror to receive this beam and direct it towards the image forming concave. This change of direction of the reflected beam, due to the change of declination of the sun, is provided for by attaching the mirror to a carriage rolling on ways in a north and south direction, the mechanism for changing the position of the secondary being identical with that used for moving the coelostat and the concave mirror, and being well shown in the figures. During the winter when the sun is low in the sky, the secondary has to be brought close to the coelostat, and in the summer away from it. The secondary mirror, also of 20 inches diameter, can be quickly adjusted in inclination by quick and slow motions so as to send the beam directly to the concave mirror.

The latter of 18 inches diameter and 80 feet focus is movable in the north and south direction over ways about 20 feet long, in order to be able to vary the position of the image for different purposes. It is also adjustable vertically and has slow motions provided for moving around a vertical and horizontal axis in order to place any desired part of the image, say, on the slit of the spectroscope or in any other required position. The beam of light from this mirror passes directly under the secondary mirror through the opening in its support, and is inclined downward $3\frac{1}{2}°$, the same inclination being given to the ways on which the concave mirror carriage moves. This inclination was adopted in order to enable the coelostat to be raised a little above

FIG. 13—Cœlostat House.

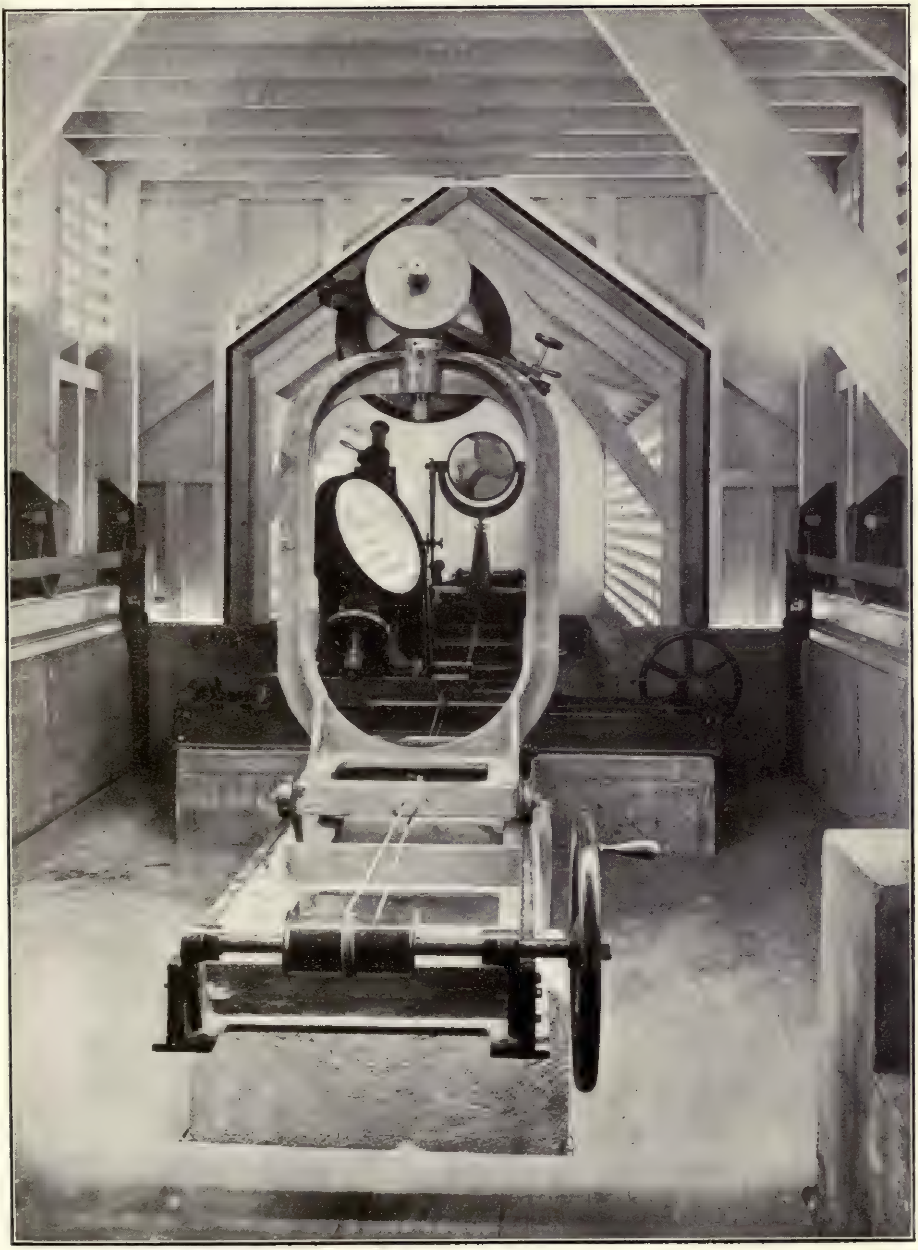


FIG. 14—Cœlostat Telescope Mechanism, looking north.

Fig. 15—Cœlostat Telescope Mechanism, looking south.

the surface of the ground, and to keep the beam some distance away from the roof of the tunnel.

The coelostat was made by the J. A. Brashear Co., in 1905, for eclipse purposes, and the secondary and concave mirrors in 1907. The designs and drawings for the remainder of the mechanical parts were made by myself, while the mechanism was constructed by the Victoria Foundry. It was found necessary, owing to the vibration of the secondary mirror support and carriage by the wind, to design one of a heavier pattern, which has been constructed by the same firm since the photographs were made, and entirely overcomes the difficulty.

The definition given by this equipment is much better than was expected from the somewhat unfavourable conditions, such as the low position of the coelostat, and the presence of the unventilated tunnel through which the beam passes. Its location north of the Observatory is also objectionable on account of radiation or convection from the building, affecting the beam between coelostat and sun. However, as the position of the installation was the only one available, we were forced to make the best of these adverse conditions and as the result shows successfully. In the early morning and the late afternoon when the mirrors are in their normal condition the definition is very good, but this is soon deteriorated by the irregular figure produced by the heating action of the sun on the mirrors. However, by keeping them shielded from the sun's rays except during actual use, this causes no especial difficulty in solar rotation work.

RADIAL VELOCITIES.

The work of determining the radial velocities of stars has been actively carried on during the last year, the addition to the staff enabling a considerable increase in the number of measurements made, and in the amount of computational work accomplished. So far as observing is concerned, however, the weather has not been as good as in the previous year. In April and May there were considerably fewer observing nights, many of them also being rendered practically useless by haze. June, July and August were good, but they were followed by three months in which very few useful spectra were obtained owing to continuous dense smoke at first and afterwards to cloudy weather. The remainder of the year has been of about average quality. There have been photographed in the year, 1,010 spectra, 18 sun for use with the spectro-comparator and 992 star spectra on 160 nights. Of these 218 have been made with the three-prism, 698 with the one-prism and 94 with the new one-prism spectrograph.

Of these spectra, 775 have been measured and reduced. Probably a number of spectra made previous to April 1, 1908, have also been measured during the past year, but we have no record of the exact number.

Detailed measures, which in this report have all been collected together at the end (Appendix E), have been made of 635 plates, of which 581 are used in obtaining the orbits of the five binary stars discussed below. The other 54 are measures of two stars whose orbits are not yet completed. The remaining 138 plates measured are chiefly of spectroscopic binaries under investigation, but they also include a number of plates of some early type stars not known to be binaries.

The five binaries discussed below with the number of plates used for each are:—

Star.	Right Ascension		Declination.		No. of Plates.
	h.	m.			
β Orionis	5	10	− 8°	19′	273
θ Aquilæ	20	06·2	− 1	7	54, + 43 in 1908
α Coronæ Borealis	15	30·4	+27	3	103
ε Herculis	16	56·5	+31	4	106
η Boötes	13	49·9	+18	54	45

The 34 measures of δ Aquilæ which follow are given for the reason that there seems little prospect of obtaining an orbit and little use, owing to the uncertainty of the results and the small range in velocity, in carrying the work on this star any further.

The binaries under observation here at present are given in the following table. In two of these stars τ Tauri, B.D. – 1° 1004, and ν Orionis, the work is well advanced, but on many of the others not much has yet been done:—

BINARIES UNDER OBSERVATION.

—	R.A.		Declination.		Mag.	Type.
	h.	m.	°	′		
φ Persei	1	37	+ 50	11	4·3	I a 2
τ Tauri	4	36	+ 22	36	4·2	I b
γ Camelopardalis	4	49·3	+ 53	35	4·7	VII a
B. D. – 1° 1004	5	36	– 1	11	5·1	I b
ν Orionis	6	1·8	+ 14	47	4·6	IV a.b
γ Geminorum	6	31·9	+ 16	9	2·9	VIII a
ω, Ursæ Majoris	10	48·2	+ 43	43	4·7	I a 2
93 Leonis	11	43	+ 20	46	4·8	XII
γ Corvi	12	11	– 16	59	3·3	VI a
δ Herculis	17	11	+ 24	57	3·7	VII b
B.A.C. – 5890	17	21·3	– 5	0	4·8	XII
α Ophiuchi	17	30	+ 12	37	2·9	XIII b
γ Aquarii	22	16	– 1	53	4·1	VII a

The majority of these stars have, as will be noticed, early type spectra and in many of them the lines are very diffuse; consequently many plates are required before a satisfactory orbit can be obtained, an example of this being given in the preceding table of the binaries completed, where the average number of plates used is well over 100.

In the measures of stars not known to be binaries, those that were observed having in every case spectra of the hydrogen or helium type generally with diffuse lines, the following four stars were discovered to be variable in their velocity:—

NEW SPECTROSCOPIC BINARIES.

Star.	R. A.		Declination.		Mag.	Type.
	h.	m.	°	′		
δ Herculis	17	11	+ 24	57	3·7	VII b
γ Aquarii	22	16·5	– 1	53	4·1	VII a
ι Andromedæ	23	33·2	+ 42	43	4·4	A
ξ Persei	3	52·4	+ 35	30	4·4	I b

In addition to the above, β Orionis is definitely announced as of binary character, but as it is more fully discussed later, nothing more need be said about it here.

δ *Herculis.*

Practically the only lines measurable in this spectrum are the hydrogen series, and these are very diffuse and difficult to measure. Consequently, the measures are

subject to much uncertainty, and it was only after several plates had been obtained that its binary character was established. The velocities are as follows:—

Plate Number.	Date.	Velocity.	Plate Number.	Date.	Velocity.
	1907.			1908.	
839	June 12·79	− 27	1404	March 16·93	− 44
894	" 27·74	− 9	1480	April 13·83	− 73
929	July 9·66	− 35	1495	" 15·89	− 47
	1908.		1512	" 22·89	− 57
			1532	May 15·85	− 47
			1541	" 18·81	− 18
1392	March 8·89	− 59			

The variability in its velocity was discovered by Mr. Harper.

γ *Aquarii.*

This star is of the hydrogen type, having *Mg.* 4481, *Fe* 4549, *Ca* 3934, in addition to the hydrogen lines, and the measures are consequently much more reliable than the previous star. They are:

Plate Number.	Date.	Velocity.	Plate Number.	Date.	Velocity.
	1908.			1908.	
1745	July 29·86	− 18	1790	August 17·81	− 40
1770	August 5·81	− 8	1847	" 28·70	− 7
1779	" 7·81	+ 3	1858	" 31·77	+ 23

Its variability was discovered by Mr. Cannon.

ι *Andromedæ.*

The spectrum of this star is similar to that of γ Aquarii, having the hydrogen *Mg.* 4481, and *K* lines, although possibly not so well defined. Its variability was discovered by Mr. Cannon, and it was announced in the Journal of the Royal Astronomical Society of Canada, Vol. II., No. 5. I learned afterwards that it had been informally announced by Prof. Frost at the Put-in-Bay meeting of the Astronomical and Astrophysical Society of America. Although present at the meeting, I had taken no notes and had forgotten its announcement. The discovery here was consequently entirely independent. The velocities of all the plates measured here are given:

Plate Number.	Date.	Velocity.	Plate Number.	Date.	Velocity.
	1908.			1908.	
1772	August 5·87	− 6	1954	November 9·58	0
1781	" 7·87	− 11	1963	" 13·60	+ 14
1832	" 26·87	+ 12	1969	" 16·69	+ 29
1922	October 9·76	− 36	1971	" 20·59	− 13
1928	" 12·71	− 14	1977	" 21·53	+ 7
1939	" 19·63	+ 6	1995	December 2·55	+ 1

ξ Persei.

The spectrum of this star is of the helium type, and is principally characterized by the extreme breadth and diffuseness of the lines. Frost and Adams, in 1903, published the measures of some plates which agreed well within errors of observation in giving it a positive velocity of 85km. per second. They surmised that later plates might show the velocity to be variable. Consequently, I thought it desirable to obtain a few plates here, and their measures by Mr. Cannon soon showed that the star was a binary. I have since learned personally from Prof. Frost that this had been a long time established by them. The following are all the velocities measured here:—

Plate Number.	Date, G. M. T.	Velocity.	Plate Number.	Date, G. M. T.	Velocity.
	1908.			1908.	
1946	October 30·37	+ 120	1974	November 20·83	+ 45
1953	November 6·66	+ 143	1998	December 2·69	+ 32
1958	" 9·77	+ 54	1999	" 4·72	+ 51
1964	" 13·65	− 2			

δ Aquilæ.

Mr. Parker has spent considerable time at work on δ Aquilæ without being able to obtain a period, and it looks as if the small range, combined with the poor quality of the spectrum, will prevent any orbit being determined. Mr. Parker has also been unfortunate in the other binary on which he has been engaged, τ Tauri, which has very bad lines in its spectrum and over which he has spent a great deal of time. He has, however, determined the period as nearly 1·5 days, but it has not been thought desirable to complete the work until further plates are secured next season. Consequently no measures of it will be given in this report, but a summary of the measures and some data concerning δ Aquilæ are given below, while the detailed measures are given in Appendix E.

This star ($\alpha = 19^h\ 20^m{\cdot}5$, $\delta = 2°\ 55'$) was discovered to be of variable velocity by Campbell and Curtis from observations made at the Lick Observatory in 1900-03.* Observations were begun upon it here in August, 1906, and since then some thirty-four plates have been measured and computed. δ Aquilæ is taken as the typical star in Group XI., according to Miss Maury's classification.† The principal lines in the spectrum are those of hydrogen, iron, magnesium and titanium. All, and especially those of hydrogen, are broad and not defined, the region measured being from H_β to λ 4005. These will be found in Table I. The range of resulting radial velocities, as seen in Table II. is not large (− 15 to − 47kms.), and, as yet the period cannot be determined from the curve of the present observations.

* L.O.B., 1903, A. J. XVIII., 306.

† Annals Harvard College Observatory, Vol. 28.

TABLE I.

PRINCIPAL LINES MEASURED IN δ AQUILÆ.

Wave-Length.	Element.	Wave-Length.	Element.
4861·527	H	4274·922	Ti & Cr
4549·766	Fe & Ti	4271·760	Fe
4534·139	Ti	4260·640	Fe
4501·448	Ti	4246·996	Y
4481·400	Mg	4227·010	Fe
4443·976	Ti	4216·351	Fe
4404·927	Fe	4198·494	Fe
4395·286	Ti, V, Zy.	4143·928	Fe
4374·905	Ti	4102·000	H
4340·634	H	4071·901	Fe
4325·939	Fe	4063·756	Fe
4320·992	Sc	4045·975	Fe
4282·722	Fe	4005·429	Fe

TABLE II.

TABLE OF OBSERVATIONS OF δ AQUILÆ.

Plate.	Date, G. M. T.	Velocity.
368	1906, August, 6·73	−41·8 kms.
377	" 15·65	45·2
382	" 24·65	45·1
390	Sept. 10·64	25·0
399	" 27·61	29·0
413	Oct. 23·57	37·7
803	1907, May, 31·79	29·9
818	June, 10·80	42·8
904	July, 2·76	19·5
923	" 8·75	28·0
930	" 9·68	15·6
938	" 10·68	18·5
966	" 25·68	16·5
980	Aug. 3·61	25·7
982	" 5·68	29·4
1034	Sept. 6·65	25·4
1049 (a)	" 18·58	25·9
1049 (b)	" 18·58	28·0
1543	1908, May, 18·83	21·9
1550	" 22·85	40·1
1575	June, 3·83	28·2
1575	" 3·83	31·6
1584	" 5·85	35·5
1633	" 24·77	29·5
1642	" 26·78	39·8
1650	" 27·75	40·9
1660	July, 3·77	21·9
1678	" 8·75	36·4
1690	" 10·77	26·1
1695	" 11·77	34·6
1703	" 13·78	47·0
1753	" 31·69	30·7
1754	" 31·72	39·1
1768	August, 5·75	29·7
1783	" 15·73	31·9
1837	" 27·62	−39·5

THE ORBIT OF β ORIONIS.

As was mentioned in my report of last year, under a description and discussion of the effect of slit-width on the errors of setting, this star showed such a difference in the mean velocities obtained on two nights (mean of 10 plates on March 20, 24·9km.; mean of 12 plates on March 24, 20·6km.) as to lead to a strong suspicion of the variability of its velocity. This suspicion was strengthened by plates obtained on other nights up to April 13, 1908, and it was decided on account of its brightness and its interesting history to follow it closely as soon as it again came into position where it could be observed.

The radial velocity of β Orionis was first determined at Potsdam by Vogel and Scheiner* in the years 1888-1891, in the beginning of photographic determinations of radial velocity. From their measures of the 14 plates, velocities varying between about + 3 and + 34kms. per second were obtained. They suspected a variation in the star's velocity due to orbital motion, but were unable to obtain evidence of its periodicity, and the accuracy of these early measures was scarcely sufficiently high to decide the question. The next published measures of the star's velocity were by Frost and Adams† from plates obtained in 1901-1902. They found values ranging between + 14·9 and + 23·4km., but they attributed this range to the character of the lines in the star's spectrum and concluded that their results showed no indication of variability in velocity. The measures of 5 plates of β Orionis obtained at the Lick Observatory‡ indicate a range of 10km. from + 15 to + 25km., in its velocity, but Campbell and Curtis in discussing these measures attribute this range to the small number of lines available, to their poor quality, and to over-exposure of some of the negatives. They consider that proper exposure would considerably reduce the observed range, and conclude that their results do not give any evidence of variability of velocity. However, a recent personal communication from Prof. Campbell informs me that they have suspected variation, but owing to press of their regular programme have not followed up the matter.

There seemed to be no question of the smallness of the range in velocity, if any, and it was evident that the only hope of obtaining anything definite, considering this and the fairly large accidental errors of a velocity determination owing to the character of the lines of the spectrum, was to obtain several plates on each night the star was observed and use their mean velocity as the velocity of the star at their mean epoch. As the star is bright, a spectrum can be obtained in ten minutes or less with the three-prism spectrograph, and in about two minutes with the one-prism. Consequently not much time is required to obtain half a dozen plates and unless the period is very short no error due to change of phase can enter. The probable error of a night's observation will by this means be considerably reduced and a much better chance obtained of determining its period of variation.

Plates were accordingly obtained whenever possible until the star became inaccessible in April, 1908, and observations were continued during the present season until March 23, 1909. Owing to the very smoky and cloudy weather last fall, very few plates were obtained until December. In all 273 plates, obtained on 54 nights, have been used in this discussion. Of these 150 were made with a dispersion of three prisms, 123 with one prism. The investigation on slit-width in the last report showed that lower probable errors were obtained with the higher dispersion and it was used wherever possible. However, the star was also observed with the one-prism spectrograph when our programme would not permit the use of three prisms. Three-fourths of the observations and all the measurements were made by myself in order to avoid as far as possible any chance of systematic discrepancies.

*Potsdam Publications, Band VII., p. 146.
† Publications of the Yerkes Observatory, 2, 61.
‡ Lick Observatory Bulletin No. 70.

The star β Orionis is of the helium type, Miss Maury's VI.c, and has fairly well defined lines of hydrogen and helium, the magnesium λ 4481 and the calcium *H* and *K*. It also contains lines due to silicon, oxygen and carbon and a few faint metallic lines. In my early measures for slit-width effect eight lines were measured in the three-prism plates and seven in the single-prism plates.

Lines measured in β Orionis.

Three-Prism Plates.	One-Prism Plates.
4862 *H*	4862 *H*
4481 *Mg*	4481 *Mg*
4472 *He*	4472 *He*
4388 *He*	4341 *H*
4341 *H*	4102 *H*
4131 *Si*	4026 *He*
4128 *Si*	3934 *Ca*
4102 *H*	

It was found, however, that lower probable errors were obtained where the three best lines λ 4481, 4472, 4341 only were used than when more or all of the measured lines were discussed. Consequently in the later plates only the three lines mentioned above have been measured and in general four comparison lines, thus considerably lightening the labour. Considerable difference in the quality of the negatives for measurement, even when taken under, so far as could be judged, identical conditions, has been noticed; this difference seems to lie principally in the character of the lines themselves. They are sometimes sharply defined and symmetrical, at others not so sharp and apparently stronger at one side. Sometimes also the contrast between them and the continuous spectrum appears considerably diminished. These changes seem almost too marked to be due entirely to instrumental or photographic effects, and one would be inclined to attribute part at any rate to changes in the spectrum. No evidence can be found, however, of any dependence of this quality of the lines upon the phase of the orbit.

In the measurements the lines were weighted according to their apparent quality and the weighted mean velocity used. In combining the separate plates on each night they were also weighted, partly according to their quality and partly according to the internal agreement of the measures, and finally the resultant mean velocity for the night was similarly weighted for use in the grouping and discussion.

The record of the observations and the individual plate measures are given in Appendix E, where all the measures are collected together, while a summary of the velocities, &c., is given in the following table:—

β ORIONIS.

Summary of Measures.

Plate Number.	Date.	G.M.T.	Julian Date.	Velocity.	Residual.
	1908.				
1241 a	January 20	15·02	2,417,961·63	+23·3	+ 2·4
1241 b	" 20	15·06	961·63	+20·9	0·0
1241 c	" 20	15·10	961·63	+25·4	+ 4·5
1242 a	" 20	15·12	961·63	+23·7	+ 2·8
1242 b	" 20	15·15	961·64	+25·9	+ 5.0
1242 c	" 20	15·18	961·64	+19·7	− 1·2
1243 a	" 20	15·24	961·64	+21·3	+ 0·4
1243 b	" 20	15·27	961·65	+23·5	+ 2·6
1243 c	" 20	15·30	961·65	+24·8	+ 3·9
1244 a	" 20	15·43	961·66	+24·5	+ 3·6
1244 b	" 20	15·47	961·66	+16·5	− 4·4
1244 c	" 20	15·50	961·66	+26·4	+ 5·5
1245 a	" 20	15·52	961·66	+25·0	+ 4·1
1245 b	" 20	15·54	961·66	+21·8	+ 0·9
1245 c	" 20	15·56	961·66	+20·5	− 0·4
1247 a	" 20	16·15	961·68	+23·8	+ 2·9
1247 b	" 20	16·17	961·68	+31·3	+10·4
1247 c	" 20	16·19	961·68	+19·0	− 1·9
1248 a	" 20	16·25	961·68	+11·6	− 9·3
1248 b	" 20	16·27	961·68	+ 5·8	−15·1
1248 c	" 20	16·29	961·68	+36·1	+15·2
1249 a	" 20	16·35	961·69	+14·0	− 6·9
1249 b	" 20	16·37	961·69	+16·0	− 4·9
1249 c	" 20	16·39	961·69	+24·2	+ 3·3
1285 a	" 27	15·45	968·68	+15·3	− 5·8
1285 b	" 27	15·51	968·66	+19·2	− 1·9
1285 c	" 27	15·57	968·67	+17·9	− 3·2
1286 a	" 27	16·03	968·67	+21·3	+ 0·2
1286 b	" 27	16·09	968·67	+18·7	− 2·4
1286 c	" 27	16·15	968·67	+24·3	+ 3·2
1289 a	" 27	17·13	968·72	+18·1	− 3·0
1289 b	" 27	17·17	968·72	+19·9	− 2·3
1289 c	" 27	17·21	968·72	+27·8	+ 6·6
1290 a	" 27	17·24	968·73	+15·6	− 5·6
1290 b	" 27	17·28	968·73	+21·6	+ 0·4
1290 c	" 27	17·32	968·73	+16·1	− 5·1
1405	March 20	11·51	2,418,021·50	+23·1	− 1·4
1406	" 20	12·07	021·50	+24·3	− 0·2
1407	" 20	12·21	021·51	+21·4	− 3·1
1408	" 20	12·32	021·52	+24·9	+ 0·4
1409	" 20	12·46	021·53	+28·0	+ 3·5
1410	" 20	13·00	021·54	+23·3	− 1·2
1411	" 20	13·12	021·55	+23·5	− 1·0
1412	" 20	13·27	021·56	+24·9	+ 0·4
1413	" 20	13·47	021·57	+27·5	+ 3·0
1414	" 20	13·57	021·58	+26·9	+ 2·4
1426	" 24	12·03	025·50	+19·2	− 2·9
1427	" 24	12·15	025·51	+21·1	− 1·0
1428	" 24	12·23	025·52	+19·2	− 2·9
1429	" 24	12·36	025·52	+21·6	− 0·5
1430	" 24	12·42	025·53	+18·8	− 3·3
1431	" 24	12·52	025·53	+18·6	− 3·5
1433	" 24	13·16	025·55	+17·5	− 4·6
1434	" 24	13·32	025·56	+19·3	− 2·8
1435	" 24	13·39	025·57	+16·1	− 6·0
1436	" 24	13·46	025·57	+17·2	− 4·9
1437	" 24	13·56	025.58	+18·7	− 3·4
1438	" 24	14·07	025·58	+18·0	− 4·1
1439	" 30	12·19	031·51	+14·4	− 4·1
1440	" 30	12·29	031·52	+14·4	− 4·1
1441	" 30	12·38	031·53	+14·5	− 4·0
1442	" 30	12·49	031·53	+17·0	− 1·5
1448	April 3	12·16	035·51	+24·9	+ 1·5
1449	" 3	12·28	035·52	+27·9	+ 4·5
1450	" 3	12·40	035·53	+32·2	+ 8·7
1451	" 3	12·53	035·53	+27 1	+ 3·6

β ORIONIS.

Summary of Measures—*Continued.*

Plate Number.	Date.	G.M.T.	Julian Date.	Velocity.	Residual.
	1908.				
1457	April 4	12·19	2,418,036·51	+29·9	+ 5·0
1458	" 4	12·28	036·52	+27·4	+ 2·5
1459	" 4	12·37	036·53	+27·0	+ 2·1
1469	" 13	12·10	045·51	+21·3	− 2·0
1470	" 13	12·22	045·52	+25·0	+ 1·7
1471	" 13	12·34	045·52	+24·8	+ 1·5
1873	September 7	21·52	192·92	+28·2	+ 2·2
1874	" 7	22·10	192·93	+27·1	+ 1·1
1935	October 13	21·19	228·90	+18·3	− 0·2
1936	" 13	21·48	228·91	+17·0	− 1·5
1937	" 13	22·19	228·93	+17·5	− 1·0
1938	" 13	22·47	228·95	+14·3	− 4·2
1978	November 21	18 24	267 77	+17·0	− 4·2
1979	" 21	18·43	267·78	+17·3	− 3·9
1980	" 21	19·05	267·79	+24·5	+ 3·3
1981	" 21	19·33	267·81	+25·0	+ 3·8
1984	" 28	16·05	274·67	+21·0	+ 0·9
1985	" 28	16·34	274·69	+22·7	+ 2·6
1986	" 28	17·08	274·71	+20·5	+ 0·4
1987	December 1	17·53	277·75	+16·4	− 8·9
1988	" 1	18·18	277·76	+20·9	− 4·4
1989	" 1	18·36	277·77	+16·1	− 9·2
1990	" 1	18·52	277·78	+23·1	− 2·2
2003	" 5	16·10	281·67	+22·6	− 3·1
2004	" 5	16·22	281·68	+25·1	− 0·6
2005	" 5	16·38	281·69	+25·6	− 0·1
2006	" 5	16·53	281·70	+27·5	+ 0·8
2054	" 21	15·24	297·64	+21·5	− 0·6
2055	" 21	15·29	297·65	+21·9	− 0·2
2057	" 21	16·54	297·70	+25·7	+ 3·6
2058	" 21	17·00	297·71	+22·0	− 0·1
2065	" 22	17·38	298·73	+28·1	+ 4·0
2066	" 22	17·52	298·74	+21·7	− 2·4
2067	" 22	18·02	298·75	+23·1	− 1·0
2068	" 22	18·14	298·76	+23·2	− 0·9
2070	" 23	14·01	2 9·58	+20·9	− 4·3
2071	" 23	14·41	299·61	+26·8	+ 1·6
2072	" 23	15·08	299·63	+23·5	− 1·7
2073	" 23	15·20	299·64	+21·2	− 4·0
2075	" 26	15·50	302·66	+25·6	− 0·4
2076	" 26	16·00	302·67	+25·9	− 0·1
2077	" 26	16·09	302·67	+22·5	− 3·5
2078	" 26	16·18	302·68	+22·0	− 4·0
2079	" 27	14·07	303·59	+33·2	+ 7·6
2080	" 27	15·12	303·64	+29·7	+ 4·1
2082	" 31	15·19	307 64	+22·7	− 1·0
2083	" 31	15·23	307·64	+24·7	+ 1·0
2084	" 31	15·29	307·65	+23·0	− 0·7
2085	" 31	15·57	307·67	+20·5	+ 2·8
	1909.				
2092	January 6	16·49	2,418,313·70	+19·1	− 0·7
2093	" 6	16·53	313·70	+19·6	− 0·2
2094	" 6	17·13	313·72	+18·5	− 1·3
2095	" 6	17·16	313·72	+21·2	+ 1·4
2105	" 7	12·49	314·53	+16·8	− 2·4
2106	" 7	13·01	314·54	+21·9	+ 2·7
2107	" 7	13·04	314·54	+12·8	− 7·1
2108	" 7	13·07	314·54	+20·7	+ 1·5
2111	" 7	16·27	314 69	+19·2	0·0
2112	" 7	16·37	314·69	+16·6	− 2·6
2114	" 7	16·56	314·71	+17·8	− 1·4
2117	" 8	15·48	315·66	+18·9	+ 0·2
2118	" 8	15·52	315·66	+20·3	+ 1 6
2122	" 12	11·55	319·50	+26·5	+ 4·5
2123	" 12	11·59	319·50	+26·0	+ 4·0

β ORIONIS.

SUMMARY OF MEASURES—*Continued.*

Plate Number.	Date.	G.M.T.	Julian Date.	Velocity.	Residual.
	1909.				
2124	January . . . 12	12·09	2,418,319·51	+20·5	− 1·5
2125	" 12	12·12	319·51	+21·3	− 0·7
2126	" 12	12·15	319·51	+27·2	+ 5·0
2127	" 12	12·18	319·51	+25·5	+ 3·5
2128	" 13	15·36	320·65	+30·2	+ 6·1
2129	" 13	15·41	320·65	+15·7	− 8·4
2130	" 13	15·46	320·66	+28·8	+ 4·7
2141	" 15	14·54	322·62	+18·6	+ 7·3
2142	" 15	15·11	322·63	+24·5	− 1·4
2143	" 15	15·15	322·63	+27·2	+ 1·3
2144	" 15	15·19	322·64	+21·8	− 4·1
2151	" 16	12·25	323·52	+31·4	+ 5·3
2152	" 16	12·36	323·52	+27·6	+ 1·5
2153	" 16	12·44	323·53	+34·4	+ 8·3
2154	" 16	12·52	323·53	+40·9	+14·8
2155	" 16	12·59	323·54	+33·0	+ 6·9
2156	" 16	13·12	323·55	+35·8	+ 9·7
2157	" 17	13·48	324·57	+29·9	+ 3·9
2158	" 17	13·56	324·58	+26·2	+ 0·2
2161	" 18	12·41	325·53	+37·1	+11·5
2162	" 18	12·46	325·53	+31·3	+ 5·7
2163	" 18	12·51	325·53	+28·3	+ 2·7
2164	" 18	13·06	325·54	+35·8	+10·2
2165	" 18	13·10	325·55	+31·2	+ 5·6
2166	" 18	13·14	325·55	+30·5	+ 4·9
2177	" 26	10·36	333·44	+24·6	+ 3·4
2178	" 26	10·51	333·45	+17·8	− 3·4
2179	" 26	10·56	333·46	+24·9	+ 3·7
2180	" 26	11·01	333·46	+23·5	+ 2·3
2181	" 26	11·11	333·47	+22·4	+ 1·2
2182	" 26	11·16	333·47	+16·2	− 5·0
2183	" 26	11·21	333·47	+20·5	− 0·7
2184	" 28	11·21	335·47	+16·3	− 3·6
2185	" 28	11·25	335·48	+23·2	+ 3·3
2186	" 28	11·29	335·48	+14·2	− 5·7
2187	" 28	11·41	335·48	+14·3	− 5·6
2188	" 28	11·44	335·49	+10·6	− 9·3
2189	" 28	11·47	335·49	+18·4	− 0·9
2195	" 29	12·53	336·54	+14·9	− 4·3
2196	" 29	12·57	336·54	+17·9	− 1·3
2197	" 29	13·01	336·54	+26·4	+ 7·2
2198	" 29	13·05	336·54	+22·1	+ 2·9
2201	" 30	12·29	337·52	+14·0	− 4·7
2202	" 30	12·41	337·53	+17·3	− 1·4
2203	" 30	12·45	337·53	+25·0	+ 6·3
2204	" 30	12·48	337·53	+14·2	− 4·5
2205	" 30	15·47	337·66	+21·0	+ 2·3
2206	" 30	16·04	337·67	+22·6	+ 4·1
2207	" 30	16·24	337·68	+22·3	+ 3·8
2211	" 31	17·16	338·72	+19·8	+ 1·2
2212	" 31	17·20	338·72	+23·2	+ 4·6
2213	" 31	17·24	338·73	+16·0	− 2·6
2214	" 31	17·29	338·73	+16·6	− 2·0
2215	February . . 2	11·14	340·47	+24·8	+ 4·6
2216	" 2	11·23	340·48	+23·1	+ 2·9
2217	" 2	11·26	340·48	+23·6	+ 3·4
2218	" 2	11·29	340·48	+22·5	+ 2·3
2219	" 2	11·41	340·49	+16·5	− 3·7
2220	" 2	11·45	340·49	+21·5	+ 1·3
2236	" 6	12·29	344·52	+18·2	− 7·7
2239	" 6	12·50	344·53	+20·0	− 5·9
2240	" 6	12·52	344·53	+21·0	− 4·9
2241	" 6	16·12	344·68	+21·9	− 4·0
2242	" 6	16·43	344·70	+19·1	− 6·8
2243	" 7	15·11	345·63	+21·0	− 5·1
2244	" 7	15·25	345·64	+21·9	− 4·2

β ORIONIS.

SUMMARY OF MEASURES.—*Continued.*

Plate Number.	Date.	G.M.T.	Julian Date.	Velocity.	Residual.
	1909.				
2245	February.. 7	15·37	2,418,345·65	+18·0	− 8·1
2249	" 8	13·32	346·56	+31·6	+ 5·2
2250	" 8	13·36	346·56	+25·9	0·0
2251	" 8	13·41	346·57	+21·8	− 4·1
2252	" 8	14·01	346·58	+17·6	− 8·3
2253	" 8	14·05	346·58	+24·1	− 1·8
2254	" 8	14·09	346.59	+23·3	− 2·6
2265	" 10	12·07	348·50	+29·6	+ 4·4
2266	" 10	12·12	348·51	+23·3	− 1·9
2267	" 10	12·16	348·51	+16·9	− 8·3
2268	" 10	12·21	348·51	+12·8	−12·4
2269	" 10	12·33	348·52	+20·3	− 4·9
2270	" 10	12·37	348·53	+23·0	− 2·2
2272	" 11	11·26	349·48	+18·9	− 5·8
2273	" 11	11·32	349.48	+33·4	+ 8·7
2274	" 11	11·35	349·48	+30·8	+ 6·1
2275	" 11	11·38	349·49	+19·7	− 5·0
2276	" 11	11·46	349·49	+17·3	− 7·4
2277	" 11	11·49	349·49	+23·5	− 1·2
2278	" 13	12·27	351·52	+22·2	− 1·4
2279	" 13	12·49	351·53	+22·0	− 1·6
2280	" 13	12·53	351·54	+21·4	− 2·2
2284	" 20	12·29	358·52	+17·7	− 1·4
2285	" 20	13·05	358·54	+22·6	+ 3·5
2286	" 20	15·12	358·63	+19·8	+ 0·7
2288	" 21	12·51	359·53	+21·0	+ 2·3
2289	" 21	13·07	359·54	+18·2	− 0·5
2290	" 21	13·17	359·55	+18·4	− 0·3
2291	" 21	13·27	359.56	+18·7	0·0
2292	" 22	12·02	360·50	+19·7	+ 1·1
2293	" 22	12·15	360·51	+25·1	+ 6·5
2294	" 22	12·30	360·52	+20·2	+ 1·6
2295	" 22	12·45	360·53	+20·2	+ 1·6
2309	" 27	11·35	365·48	+22·0	− 3·4
2311	" 28	11·56	366·50	+22·2	− 3·8
2312	" 28	12·07	366·50	+22·0	− 4·0
2313	" 28	12·18	366·51	+23·7	− 2·3
2314	" 28	12·27	366·52	+25·3	− 0·7
2315	" 28	12·39	366·53	+22·4	− 3·6
2316	" 28	12·50	366·53	+22·8	− 3·2
2317	March.... 2	11·05	368·46	+25·9	0·0
2318	" 2	11·19	368·47	+24·4	− 1·5
2319	" 2	11·29	368·48	+24·2	− 1·7
2320	" 3	11·36	368·48	+21·6	− 4·3
2364	" 13	12·12	379·51	+18·6	− 1·1
2365	" 13	12·24	379·52	+18·4	− 1·3
2366	" 13	12·36	379·52	+20·3	+ 0·6
2367	" 13	12·46	379·53	+17·6	− 2·1
2368	" 13	12·57	379·54	+19·3	− 0·4
2372	" 15	11·45	381·49	+16·9	− 1·8
2373	" 15	11·56	381·50	+20·5	+ 1·8
2374	" 15	12·05	381·50	+17·6	− 1·1
2375	" 15	12·13	381·51	+18·9	+ 0·2
2376	" 15	12·21	381·52	+16·2	− 2·5
2386	" 18	11·42	384·49	+19·5	− 1·1
2387	" 18	11·52	384·50	+20·0	− 0·6
2388	" 18	12·02	384·50	+21·7	+ 1·1
2389	" 18	12·12	384·51	+21·0	+ 0·4
2390	" 20	12·16	386·51	+22·2	− 2·1
2391	" 20	12·26	386·52	+18·3	− 6·0
2392	" 20	12·38	386·53	+23·4	− 0·9
2393	" 20	12·48	386·53	+21·9	− 2·4
2394	" 20	12·58	386·54	+23·1	− 1·2
2397	" 21	13·38	387·56	+23·9	− 1·6
2398	" 21	13·48	387·57	+25·2	− 0·3
2399	" 21	14·00	387·58	+24·8	− 0·7

β ORIONIS.

SUMMARY OF MEASURES—*Continued.*

Plate Number.	Date.	G.M.T.	Julian Date.	Velocity.	Residual.
	1909.				
2400	March 21	14·14	2,418,387·59	+25·5	0·0
2402	" 22	11·51	388·49	+26·0	0·0
2403	" 22	12·02	388·50	+25·0	− 1·0
2404	" 22	12·13	388·51	+21·1	− 4·9
2405	" 22	12·35	388·52	+21·2	− 4·8
2420	" 23	11·46	389·49	+23·1	− 3·0
2421	" 23	11·57	389·50	+24·4	− 1·7
2422	" 23	12·05	389·50	+25·9	− 0·2
2423	" 23	12·13	389·51	+26·2	+ 0·1
2424	" 23	12·27	389 52	+25·5	− 0 6
2425	" 23	12·38	389·53	+25·7	− 0·4

In the preceding table are given the plate number, the Greenwich mean and Julian dates, the weighted mean velocity for the plate, and finally the residual obtained by scaling from the final velocity curve. The velocities on each night were obtained by taking the weighted means of the plate velocities, the weights being assigned, as before stated, partly on the basis of apparent quality, partly according to the internal agreement of the measures. In the following table of mean velocities are given various data concerning the observations of each night, as the date, Julian date, velocity, phase, the number of plates, the dispersion used, the weight assigned and finally the residual obtained by scaling from the curve:—

β ORIONIS.

SUMMARY OF MEAN VELOCITIES PER NIGHT.

Date.	Julian Date.	Mean Velocity.	Mean Phase.	No. of Plates.	Spectrograph.	Weight.	Residual.
1908.							
Jan. 20....	2,417,961·65	22·3	0·65	24	I L	16	+1·40
" 27 ...	968·71	19·7	7·71	12	III S	6	−1·50
March 20....	2,418.021·54	24·9	16·74	10	III L	10	+0·45
" 24....	025·54	20·6	20·74	12	"	6	−1·47
" 30....	031·52	15·1	4·82	4	"	6	−3·46
April 3.. .	035·52	27·3	8·82	4	"	4	+3·87
" 4....	036·52	28·2	9·82	3	"	3	+3·28
" 13....	045·52	24·2	18·82	3	"	3	+0·93
Sept. 7....	192·92	27·1	12·92	2	"	2	+1·10
Oct. 13....	228·92	16·8	5·12	4	"	5	−1·76
Nov. 21....	267·79	22·3	0·19	4	"	3	+1·08
" 28....	274·69	21·4	7·09	3	"	2	+1·32
Dec. 1 ...	277·77	20·1	10·17	4	"	1	−5·19
" 5....	281·69	25·9	14·09	4	"	2	−1·36
" 21....	297·68	23·0	8·18	4	I L	2	+0·85
" 22....	298·75	24·0	9·25	4	III L	2	−0·10
" 23...	299·63	23·8	10·13	4	"	2	−1·43
" 26....	302·67	24·6	13·17	4	"	3	−1·36
" 27....	303·65	31·4	14·15	2	"	2	+5·77
" 31....	307·65	24·2	18·15	4	I L	2	+0·56
1909.							
Jan. 6....	313·71	19·6	2·31	4	I L	2	−0·20
" 7....	314·62	17·9	3·22	7	I & III	4	−1·34
" 8....	315·66	19·6	4·26	2	I L	1	+0·87
" 12....	319·50	24·7	8·10	6	"	3	+2·70
" 13....	320·66	24·9	9·26	3	"	1	+0·77
" 15...	322·62	24·0	11·22	4	"	1	−1·93
" 16 ...	323·53	33·4	12·13	6	"	3	+7·30
" 17....	324·57	28·1	13·17	2	"	1	+2·15
" 18....	325·54	32·4	14·14	6	"	3	+6·78
" 26....	333·47	21·3	0·17	7	"	4	+0·08
" 28...	335·49	16·7	2·19	6	"	2	−3·18
" 29....	336·54	19·7	3·24	4	"	1	+0·46
" 30....	337·61	20·0	4·31	7	I & III	5	+1·28
" 31....	338·72	18·3	5·42	4	I L	2	−0·29
Feb. 2....	340·49	21·5	7·19	6	"	4	+1·30
" 6....	344·59	20·7	11·29	5	I & III	3	−5·26
" 7....	345·64	20·0	12·34	3	III L	2	−6·08
" 8...	346·57	24·7	13·27	6	I L	2	−1·23
" 10....	348·52	21·0	15·22	6	"	1	−4·17
" 11....	349·49	23·9	16·19	6	"	1	−0·83
" 13....	351·53	21·9	18·23	3	III L	3	−1·71
" 20....	358·57	19·4	3·37	3	"	2	−0·36
" 21....	359·55	19·2	4·35	4	"	3	+0·49
" 22....	360·52	20·0	5·32	4	"	3	+1·43
" 27 ...	365·48	22·0	10·28	1	"	1	−3·38
" 28....	366·53	22·8	11·33	6	"	4	−3·18
March 2...	368·47	23·4	13·27	4	"	2	−2·52
" 13....	379·53	18·8	2·43	5	"	5	−0·91
" 15 ...	381·50	18·0	4·40	5	"	3	−0·68
" 18....	384·50	20·55	7·40	4	"	3	−0·04
" 20 ...	386·53	22·2	9·43	5	"	4	−2·15
" 21....	387·57	24·85	10·47	4	"	3	−0·68
" 22...	388·51	23·3	11·41	4	"	2	−2·69
" 23....	389·51	25·1	12·41	6	"	4	−0·97

It was not difficult to trace periodic changes in the velocities thus determined, and comparatively early in the present season the period was found to be very nearly 21·90 days. The Potsdam observations, however, did not group themselves satisfactorily with this period, and owing to their probably inferior accuracy were not considered. The Yerkes observations showed a fairly satisfactory arrangement, although there were some discrepant single plates, due possibly to accidental errors of setting on the rather

broad lines of the spectrum, or to another cause to be referred to later on. The Lick observations, extending over seven years, followed the velocity curve determined as closely as could be expected, although as there are only five plates this agreement may be accidental. It was found, however, that a period of 21·87 instead of 21·90 days was required to bring the Lick observations forward to ours.

Although some discrepancies are to be expected on account of the small range in velocity and the relatively high errors of measurement, still it was felt that all the irregularities noted could not be explained on the above grounds. Consequently, although sufficient evidence had been secured of the binary character of β Orionis and sufficient data to obtain the elements of the orbit by the end of January, it was deemed desirable to continue the observations in the hope of finding a clue to some of the anomalies. The later observations revealed some peculiar and interesting features in the star's motion which served, if not to explain the cause of the irregularities, at least to indicate a reason for their existence.

The phase of minimum velocity due January 30-31 followed prediction, but the succeeding maximum, due February 6-7, although present, was of much lower amplitude than those previously obtained. The curve already drawn showed a range of velocity between about + 17 and + 29km. The maximum of February 6 reached only about 23km., and the succeeding minima and maxima until the end of the observations were as follows:— + 19·5, + 23·0; + 18·5, + 24·5; 19·0, + 24·5. All of these values, as well as the previous ones, depend upon several plates, and there is no doubt in my mind that they indicate, if not a change in the amplitude of the velocity curve, certainly some progressive shift in the position of the absorption maximum of the lines measured due to some physical cause in the star's atmosphere. If it is a change in the amplitude of the motion, it may be due to the presence of a third body and will probably be periodic. If an epoch of low amplitude occurred in 1901-1902 this, together with the fact of their only making one plate per night and the consequently higher accidental errors, would form a sufficient explanation why Frost and Adams with the high accuracy of their work were unable to find any periodicity in the motion. Furthermore, a change in the amplitude is probably accompanied by changes in the other elements of the orbit, which may account for the slight change in the period requisite when the Lick observations are brought up to the same epoch as those at Ottawa.

If all the Ottawa observations are plotted continuously on cross-section paper, they form a curve somewhat similar to the trace given by two beating tuning forks. It shows curves similar to the velocity curve of Fig. (16) periodically repeated with gradually increasing amplitude, then with a sudden diminution followed by another gradual increase. The observations have not been sufficiently continuous or extended to decide whether this variation in amplitude is periodic, and in any case the very small range combined with the comparatively poor quality of the spectrum for measurement would render such a determination difficult and uncertain even if a very large number of plates were obtained.

I have, therefore, thought it preferable now, as all these successive curves have, so far as can be determined, the same form, to consider the variations in amplitude as accidental or, if you like, as due to errors in measurement; and to obtain a mean curve and from it the elements of the orbit by grouping together into normal places the mean velocities obtained on the 54 nights under discussion. The period chosen was that mentioned above, 21·90 days, which best suited our own and the Lick observations and which under the conditions cannot probably be improved upon. The initial phase T_0 was taken as Julian day 2,417,961·0. The basis of grouping into the normal places was the phase, the total difference in phase in the nights in a group being kept generally less than half a day, except in three groups where the velocity changes but slowly.

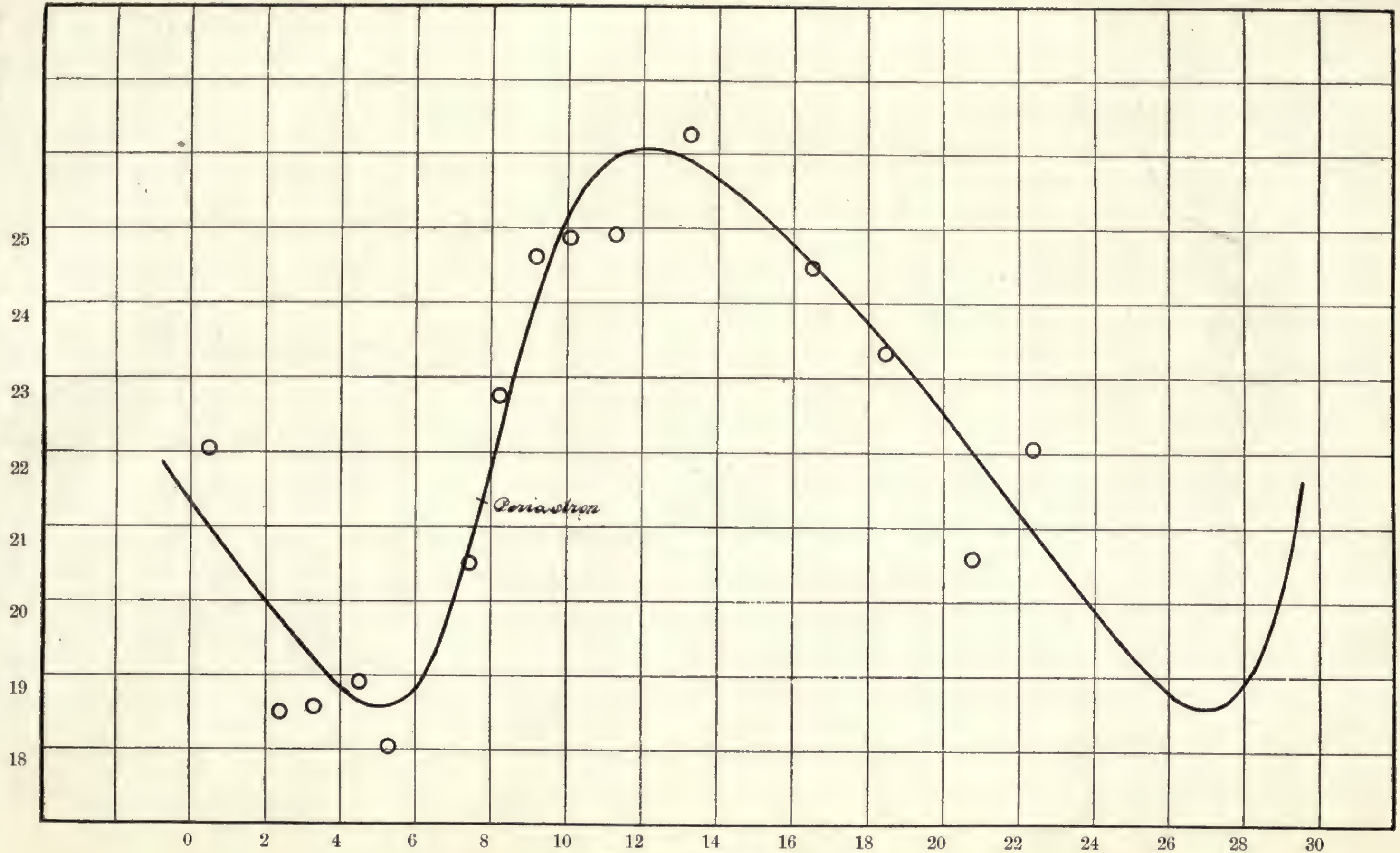


FIG. 16—Velocity Curve of β Orionis.

These normal places with other data are given in the table below, and the places themselves are indicated by circles on the velocity curve Fig. (16) corresponding to the final elements.

NORMAL PLACES β ORIONIS.

No.	Mean velocity.	Mean phase.	No. of nights.	No. of plates.	Total diff. of phase.	Weight.	Weight used in solution.	Residual O–C
1	22·06	0·444	3	35	0·48	17	$\frac{3}{4}$	+1·02
2	18·51	2·350	3	15	0·24	9	$\frac{1}{3}$	−1·24
3	18·59	3·266	3	14	0·15	7	$\frac{1}{4}$	−0·60
4	18·92	4·481	5	22	0·59	17	$\frac{3}{4}$	+0·27
5	18·06	5·240	3	12	0·30	10	$\frac{1}{2}$	−0·47
6	20·51	7·427	4	25	0·62	15	$\frac{2}{3}$	−0·10
7	22·76	8·200	2	10	0·27	5	$\frac{1}{4}$	+0·61
8	24·63	9·160	4	16	0·63	11	$\frac{1}{2}$	+0·65
9	24·90	10·024	4	10	0·46	7	$\frac{1}{4}$	−0·26
10	24·91	11·265	6	31	1·66	16	$\frac{2}{3}$	−1·10
11	26·28	13·253	10	39	1·81	23	1	+0·34
12	24·49	16·567	3	22	1·52	12	$\frac{1}{2}$	−0·05
13	23·34	18·431	3	10	0·67	8	$\frac{1}{3}$	−0·17
14	20·60	20·740	1	12	0·00	6	$\frac{1}{4}$	−1·48

With these normal places and by the graphical method developed by you, described in last year's report, the elements given below were readily determined, with which the observations seemed to agree closely. However, owing to the considerable differences in the weight of the normal places, which could not very well be allowed for in a graphical solution, and to the advantages demonstrated by previous experience, it was felt desirable to apply a least squares correction to these elements.

For coefficients of the corrections the equations developed by Lehmann-Filhés* were used, and from these and from the ephemeris obtained from the normal places and preliminary elements, the following observation equations were derived. All of the elements except the period, which was considered as closely determined as possible from the range of velocity present and the short interval used, were included in this solution and an unknown of coefficient unity for the velocity of the system was added.

OBSERVATION EQUATIONS β ORIONIS.

x $\delta\gamma$	y δK	z $K\delta\omega$	u $K\delta e$	v $\frac{K\mu\delta T}{(1-e^2)^{\frac{3}{2}}}$	V	Weight.	s
1·000	−0·505	−0·698	+0·892	+0·892	−1·51	$\frac{3}{4}$	+0·071
"	−0·851	−0·408	+0·859	+0·601	+0·74	$\frac{1}{3}$	+1·937
"	−0·975	−0·190	+0·523	+0·384	+0·20	$\frac{1}{4}$	+0·942
"	−1·052	+0·178	−0·223	+0·015	−0·42	$\frac{3}{4}$	−0·507
"	−1·020	+0·443	−0·528	−0·249	+0·56	$\frac{1}{2}$	+0·206
"	−0·464	+1·104	−0·598	−0·911	+0·19	$\frac{2}{3}$	+0·325
"	−0·138	+1·189	+0·140	−0·996	−0·83	$\frac{1}{4}$	+0·365
"	+0·267	+1·141	+0·924	−0·948	−1·18	$\frac{1}{2}$	+1·204
"	+0·569	+0·977	+0·845	−0·784	−0·33	$\frac{1}{4}$	+2·277
"	+0·876	+0·565	+0·519	−0·372	+0·80	$\frac{1}{2}$	+3·388
"	+0·941	+0·071	−0·486	+0·122	−0·31	1	+1·338
"	+0·588	−0·575	−0·869	+0·774	+0·16	$\frac{1}{2}$	+1·078
"	+0·267	−0·755	−1·366	+0·948	+0·10	$\frac{1}{3}$	+0·194
"	−0·183	−0·798	+0·460	+0·991	+1·16	$\frac{1}{4}$	+2·630

* A. N., No. 3242.

From these observation equations the following normal equations were obtained:—

$$\begin{aligned}
6{\cdot}833x - 0{\cdot}558y + 1{\cdot}110z - 0{\cdot}041u + 0{\cdot}213v - 1{\cdot}132&=0\\
-0{\cdot}558x + 3{\cdot}755y + 0{\cdot}085z - 0{\cdot}466u - 0{\cdot}192v + 0{\cdot}185&=0\\
+1{\cdot}110x + 0{\cdot}085y + 3{\cdot}284z + 0{\cdot}192u - 3{\cdot}072v - 0{\cdot}211&=0\\
-0{\cdot}041x - 0{\cdot}466y + 0{\cdot}192z + 3{\cdot}363u - 0{\cdot}202v - 1{\cdot}192&=0\\
+0{\cdot}213x - 0{\cdot}192y - 3{\cdot}072z - 0{\cdot}202u + 3{\cdot}118v - 0{\cdot}009&=0
\end{aligned}$$

From the elimination there resulted the following values of the unknowns with their probable errors:—

$$\begin{array}{lll}
x \text{ or } \delta\gamma & = +\ {\cdot}1721 & \pm\ {\cdot}1584 \\
y \text{ or } \delta K & = +\ {\cdot}0212 & \pm\ {\cdot}2096 \\
z \text{ or } K\delta\omega & = -\ {\cdot}0157 & \delta\omega = -\ {\cdot}0042 = -\ 0.24^\circ \pm 3{\cdot}48^\circ. \\
u \text{ or } K\delta e & = +\ {\cdot}3604 & \delta e = +\ {\cdot}0961 \pm {\cdot}0587 \\
v \text{ or } \dfrac{K\mu\delta T}{(1-e^2)^{\frac{3}{2}}} & = 0 & \delta T = 0
\end{array}$$

When these are applied to the preliminary values we obtain:

ELEMENTS OF β ORIONIS.

Name.	Symbol.	Preliminary.	Corrected.
Eccentricity	e	0·20	0·296 ± ·059
Half-Amplitude	K	3·75	3·771 ± ·210 km.
Longitude of Apse	ω	255°	254°·76 ± 3°·48
Periastron Passage	T	7·80	J.D. 2,417,968·80
Period	U	21·90	21·90 dys.
Velocity of System	γ	+22·444	+22·616 ± ·158 km.
Projection of Semi-axis	$a \sin i$	1,100,500	1,108,900 km.
Maximum Velocity	N_1	+26·0	+26·09 km.
Minimum Velocity	N_2	+18·5	+18·55 km.

It will be noticed that except for the eccentricity the changes in the elements are very small and a comparison between the residuals from the corrected ephemeris and from substitution in the observation equations shows that the solution is satisfactory enough, as there are none greater than ·25km. It was not deemed necessary to make a second solution considering the assumptions made in combining the observations. That the solution has improved the elements was shown at once on comparing the curves and is also evident by the reduction of Σpvv from 3·88 to 3·16.

The probable error of a normal place of unit weight is ± 0·40km. The probable error of a night obtained by scaling from the curve is ± 1·80. The probable error of a plate obtained with a dispersion of three prisms is ± 1·98km., with dispersion of one prism ± 3·22km. and including all the plates ± 2·62km. If, as was done, the observations are divided into two sets—those before and those after January 29, 1909, when the sudden change in amplitude was noticed—and separate curves and elements are obtained roughly for these sets, the probable error of a night reduces to ± 1·37km. with a proportional reduction in the probable errors of single plates, and this would probably be not much greater than 1km. if the amplitude remained constant. For the two sets mentioned above, it may be of interest to compare the maximum and minimum velocities. Those of the first set are + 17 and + 29 and of the second + 19 and + 23·5.

This solution must, however, owing to the peculiar behaviour of the star, be regarded as preliminary only. It is only when many more observations have been secured and the star has been closely followed for some time that any more definite idea of the nature of the changes taking place may possibly be obtained, and it is proposed in the future to follow it as closely as the other work on hand will permit.

I have the honour to be, sir,

Your obedient servant,

J. S. PLASKETT.

APPENDIX A.

ORBITS OF θ AQUILÆ, ϵ HERCULIS, AND η BOÖTIS.

W. E. HARPER.

THE ORBIT OF θ AQUILÆ.

The star θ Aquilæ ($\alpha = 20^h\ 06^m{\cdot}2$, $\delta = -\ 1°\ 07'$, photographic magnitude 3·6) was discovered to be a spectroscopic binary by M. Deslandres* in 1902. From the twenty-six plates secured he obtained a period of 16·7 days and eccentricity about 0·6. As the results obtained by him were regarded as only provisional, the star was placed on our observing list here in May, 1907, when the single-prism spectrograph was ready for use. In all forty-five measurable plates were secured that year and from these, preliminary values of the elements were obtained.† For convenience of reference these are given here:

$$
\begin{aligned}
P &= 17{\cdot}17^{d} \\
\gamma &= -\ 26{\cdot}7^{km} \\
e &= 0{\cdot}725 \\
\omega &= 20° \\
T &= 1907,\ \text{Oct. } 2{\cdot}15 \text{ G.M.T.} \\
&= \text{J. D. } 2{,}417{,}851{\cdot}15 \\
a \sin i &= 8{,}455{,}500^{km}
\end{aligned}
$$

As unfavourable weather prevented the securing of spectrograms in all its phases, particularly near the time of periastron passage, work was resumed on it this year with the object of filling up any gaps in the curve. Fifty-two spectrograms were secured this year and these have been combined with those of last year to determine the orbit. Some half-dozen plates of last year in which the agreement among the various lines was not all that could be desired were remeasured, but only two, Nos. 924 and 959, were changed in velocity appreciably. Plates 1038 and 1050 which had not been measured last year are also added.

Four of the plates Nos. 1001, 1100, 1101 and 1794 were made with the three-prism spectrograph, whose linear dispersion at $H\gamma$ is 10·1 tenth-metres per millimetre. The balance were all made with the single-prism spectrograph which at $H\gamma$ has a linear dispersion of 30·2 tenth-metres per millimetre and gives the whole visible spectrum in sharp focus. The region used for velocity determinations is that lying between and including $H\beta$ and K. The plates used were Seed 27.

The spectrum is of the type VII*a*, and in the portion used the *Mg* line (λ 4481) and K (λ 3933) are best defined. The hydrogen lines are fairly well measurable, especially $H\gamma$, the line λ 4549 is fairly sharp as are also the silicon lines. In addition to those given in Table I. some faint metallic lines also appear in some of the plates. The velocities corresponding to one revolution of the micrometer screw (0·5mm. pitch) are also attached.

* Bulletin Astronomique XX., 129, 1903.

† Journal of the Royal Astronomical Society of Canada I., 357, 1907.

TABLE I.

LINES IN θ AQUILÆ.

Element.	Wave-Length.	Velocity per Revolution.
H	4861·527	1451
Fe	4549·642	1204·
Mg	4481·400	1151·
H	4340·634	1044·
Fe	4233 328	964·
He	4143·928	898·
Si	4131·047	889·
Si	4128·211	887·
H	4101·890	868·
H	3970·177	774·
Ca	3933·825	749·

Practically all the plates made have been used in the discussion, even although one or two have not been of the best quality, No. 865 being a case in point. In the preliminary curve for this year ($P=17{\cdot}120$) No. 873 gave an abnormally high residual (– 28km.) and following out a suggestion of Mr. J. S. Plaskett, to whom I am much indebted for help during this work, the result was omitted from consideration in the least-square solution, as an excessive residual tends to distort the elements out of all agreement with the mean values, as obtained from the remaining observations.

The following table gives all the data of the plates, the phase being reckoned from periastron, Julian Day 2,417,731.504, using the period finally determined, 17·112 days.

TABLE II.

MEASURES OF θ AQUILÆ.

Plate No.	Julian Date.	Phase.	No. of lines.	Wt.	Velocity.	Residual.
	1907.					
803	2,417,727·814	13·425	4	5	– 24	+ 0·2
819	737·787	6·284	4	5	– 39	+ 3·1
841	739·836	8·333	4	5	– 38	– 0·4
854	741·813	10·310	4	5	– 42	– 5·9
865	747·778	16 275	1	2	+ 45	+16·0
905	759·777	11·162	5	4	– 40	– 5·2
924	765·777	0·050	5	4	+ 30	–19·5
931	766·711	0·984	7	5	– 30	+ 9·8
942	770·703	4·976	4	4	– 40.	+ 5·7
946	773·713	7·986	3	3	– 43	– 5·0
959	777·764	12·037	5	3	– 40	– 7·8
969	784·760	1·921	4	4	– 40	– 1·8
1001	798·660	15·821	5	4	+ 19	+ 6·2
1012	801·692	1·741	4	3	– 39	– 2·0
1013	803·573	3·622	6	4	– 51	– 4·1
1027	815·630	15·679	3	3	+ 10	+ 1·1
1028	815·669	15·718	2	5	+ 11	+ 1·0
1033	825·612	8·549	4	3	– 38	– 0·6
1038	831·635	14·572	4	2	– 8	+ 3·6
1043	833·673	16 610	7	3	+ 55	+10·5
1050	837·614	3·438	4	4	– 47	– 0·4
1072	849·543	15·367	5	4	+ 3	+ 1·3
1073	849·559	15·383	4	5	+ 4	+ 2·1
1074	849·589	15·413	6	5	– 7	– 9·4
1080	850·502	16·326	3	2	+ 28	– 2·6
1081	850·521	16·345	5	3	+ 33	+ 0·8
1082	850·548	16·372	6	4	+ 30	– 3·8
1085	850·613	16·437	8	5	+ 25	–10·5
1086	850·642	16·466	5	3	+ 36	– 1·0
1089	851·528	0·240	5	4	+ 18	–12·0
1091	851·570	0·282	3	2	+ 28	+ 0·2
1092	851·589	0·301	5	2	+ 23	– 2·6

TABLE II.

MEASURES OF θ AQUILÆ—*Continued.*

Plate No.	Julian Date.	Phase.	No. of lines.	Wt.	Velocity.	Residual.
	1907.					
1093	2,417,851·605	0·317	5	3	+ 26	+ 2·6
1094	851·625	0·337	2	1	+ 12	− 9·0
1100	867·510	16·223	1	1	+ 28	+ 1·7
1101	867·574	16·287	3	3	+ 33	+ 4·0
1106	874·535	6·135	4	2	− 44	+ 1·4
1128	884·437	16·038	5	5	+ 16	− 4·0
1129	884·452	16·052	5	5	+ 32	+11·6
1146	896·500	10·988	4	2	− 36	− 2·8
1149	898·448	12·936	3	1	− 31	− 3·4
1150	898·526	13·014	5	3	− 20	+ 7·2
1154	899·445	13·933	4	3	− 18	+ 1·8
1155	899·458	13·946	3	2	− 30	−10·0
1157	903·529	0·905	3	3	− 33	+ 3·9
	1908.					
1533	2,418,077·871	4·126	5	3	− 50	− 3·0
1544	080·873	7·128	2	2	− 37	+ 3·0
1576	096·857	6·000	3	3	− 48	− 5·0
1583	098·821	7·964	5	3	− 31	+ 7·0
1604	105·814	14·943	7	3	− 11	− 5·0
1605	105·843	15·000	6	3	− 15	−10·0
1626	115·774	7·805	7	4	− 29	+ 9·3
1634	117·824	9·855	7	5	− 29	+ 7·5
1643	119·821	11·852	6	5	− 30	+ 3·0
1651	120·781	12·812	9	5	− 32	− 4·0
1659	126·729	1·648	2	2	− 36	− 0·5
1679	131·785	6·704	5	3	− 39	+ 2·0
1691	133·812	8·731	5	3	− 41	− 4·0
1696	134·799	9·718	5	4	− 34	+ 2·5
1704	136·818	11·737	6	2	− 33	± 0·0
1708	137·764	12·683	5	4	− 26	+ 3·3
1716	138·809	13·728	7	5	− 19	+ 2·5
1727	148·687	6·494	5	5	− 37	+ 4·6
1730	149·735	7·542	5	4	− 39	± 0·0
1731	149·755	7·562	5	3	− 41	− 2·2
1732	150·760	8·597	5	3	− 33	+ 4·3
1733	150·840	8·617	2	2	− 41	− 3·8
1735	151·743	9·551	6	3	− 43	− 6·5
1736	151·756	9·564	2	1	− 30	+ 6·5
1747	153·740	11·547	5	3	− 31	+ 3·0
1755	154·744	12·551	5	2	− 31	− 1·0
1756	154·764	12·571	5	3	− 26	+ 4·0
1762	159·619	0·316	7	3	+ 35	+10·0
1766	159·687	0·384	4	3	+ 33	+13·0
1767	159·722	0·419	5	3	+ 16	+ 3·0
1769	159·784	0·481	3	2	± 0	− 8·0
1776	161·708	2·395	4	2	− 41	+ 1·5
1777	161·740	2·443	7	4	− 39	+ 4·0
1789	171·763	12·458	5	3	− 21	+ 9·0
1794	173·697	14·392	5	3	− 24	−10·0
1799	174·635	15·328	8	2	± 0	− 1·0
1800	174·658	15·351	6	2	− 2	− 3·0
1801	174·695	15·398	6	3	+ 7	+ 4·5
1807	175·581	16·273	6	2	+ 29	+ 1·0
1808	175·605	16·297	7	2	+ 26	− 3·0
1810	175·645	16·337	5	2	+ 22	−10·0
1811	176·645	0·228	5	3	+ 35	+ 4·0
1812	176·664	0·247	5	1	+ 39	+10·0
1813	176·681	0·264	7	2	+ 35	+ 6·0
1814	177·659	1·242	6	4	− 30	− 1·5
1815	177·680	1·263	8	4	− 33	− 4·0
1822	178·702	2·285	7	5	− 35	+ 7·0
1835	181·584	5·165	5	4	− 49	− 3·0
1864	188·678	12·259	8	5	− 33	− 1·7
1875	193·529	0·000	5	4	+ 51	− 2·0
1876	193·570	0·040	5	4	+ 51	+ 1·0
1878	2,418,196·625	3·094	5	4	− 48	− 2·0

The observations of 1907 and 1908 were grouped separately and the period which suited best was 17·120 days. The phases for this period were computed, being reckoned from an initial epoch T_0, Julian Day 2,417,727, the date of the first observation. The observations of the two years were now combined and grouped into 18 normal places. Weights were assigned to these groups depending not only upon the sum of the weights of the individual plates, but upon the number of nights involved. The maximum weight was taken as 5. In the weighting of the individual plates, not only the quality of the plate *per se,* but the agreement among the various lines was taken into account. The groups are given in Table III.

TABLE III.
NORMAL PLACES.

Mean Phase.	Mean Velocity.	Wt.	Mean Phase.	Mean Velocity.	Wt.
1·09	−22·3	3	5·49	−31·3	2
2·13	−11·7	1	6·47	−38·2	3
2·66	+ 0·7	3	7·96	−48·9	2
3·09	+13·3	1	9·46	−44·5	1
3·42	+24·9	2	10·73	−40·5	2
3·72	+34·3	3	12·05	−36·4	2
4·31	+51·0	1	13·93	−37·4	5
4·54	+33·6	1	16·28	−33·0	2
4·72	+22·5	3	17·05	−26·7	3

Using the graphical method* of Dr. King, various values of e and ω were tried, those finally decided upon as suiting the grouped observations best being $e = \cdot 680$, $\omega = 20°$, $K = 49$km. and time of periastron passage, T, 4·30 days from initial epoch. Thus for preliminary elements we have:

$P = 17{\cdot}120$ days
$e = 0{\cdot}680$
$\omega = 20°$
$T =$ Julian Day 2,417,731·30
$K = 49$km.
$\gamma = -\ 25{\cdot}3$km.

With these elements it was decided to make a least-square solution for the normal places. Using the differential equation of Lehmann-Filhés†

$$\delta\left(\frac{dz}{dt}\right) = \delta\gamma + (\cos u + e\cos\omega)\,\delta K + \left[\cos\omega - \frac{\sin u\ \sin v}{1-e^2}\cdot\ (2 + e\cos v)\right] K\,\delta e$$
$$- [\sin u + e\sin\omega].\ \ K\,\delta\,\omega - \sin u\,(1 + e\cos v)^2\,(t - T).\ \ \frac{K}{(1-e^2)^{\frac{3}{2}}}\cdot\ \delta\,\mu$$
$$+ \sin u\,(1 + e\cos v)^2\,\frac{K}{(1-e^2)^{\frac{3}{2}}}\cdot\ \ \mu.\ \ \delta\,T$$

eighteen observation equations were formed, connecting the six unknowns with the residuals between the observed and computed values of the velocity. To make the observation equations homogeneous the following substitutions were made:—

$x = \delta\gamma$
$y = \delta K$
$z = 10{,}000\delta\mu$
$u = 100\delta e$
$v = 10\delta T$
$w = 10\delta\omega$

* Astrophysical Journal, XXVII., 125, 1908.
† Astronomische Nachrichten 3242.

There result the following normal equations:—

$$
\begin{aligned}
40\cdot000x + 9\cdot571y - 15\cdot914z - 11\cdot075u + 5\cdot696v + 4\cdot981w + 18\cdot200 &= 0\\
+16\cdot015y - 19\cdot340z - 13\cdot924u + 6\cdot444v + 2\cdot043w - 6\cdot419 &= 0\\
+242\cdot697z + 11\cdot554u - 327\cdot008v + 255\cdot472w + 14\cdot267 &= 0\\
+19\cdot651u - 4\cdot122v + 1\cdot212w - 4\cdot459 &= 0\\
+486\cdot538v - 372\cdot234w - 36\cdot352 &= 0\\
+413\cdot976w - 102\cdot105 &= 0
\end{aligned}
$$

Whence the corrections to the first approximations:

$\delta\gamma = -0\cdot6$ km. $\quad$ $\delta e = + \cdot011$

$\delta K = +2\cdot1$ km. $\quad$ $\delta T = + 134$ days.

$\delta P = - \cdot004$ days. $\quad$ $\delta\omega = 5°\cdot27$

The resulting elements with their probable errors, as determined at a later stage, are:

$P = 17\cdot116$ days $\pm \cdot008$ days.
$e = 0\cdot691$ $\pm \cdot017$
$\omega = 25°\cdot27$ $\pm 2°\cdot1$
$T =$ J. D. 2,417,731·434 $\pm \cdot100$ days.
$K = 51\cdot1$ km. $\pm 3\cdot20$ km.
$\gamma = -25\cdot9$ km. $\pm 0\cdot64$
$A = 83\cdot0$ km.
$B = 19\cdot2$ km.

} Final elements (simple solution).

The residuals from the curve using these corrected values of the elements seemed themselves to lie on a curve, which repeated itself approximately twice during the period of the principal star and having an amplitude of about 8 km. The way the residuals from the observed velocities grouped themselves was not mere chance, there was no doubt that there was some secondary disturbance. The assumption was therefore made that there was a third body whose period was commensurable with the period of the principal star, it going through all its phases in half the time required for that of the principal star. The orbit of the third body was considered circular and the secondary curve taken to cross the primary from above at a time T', Julian Day 2,417,732·634. Taking K' as 4km. and considering θ as the angle at any time from T' the extra terms in the differential equation are:

$$- \sin \theta \delta K' + \frac{2\pi}{P'} \cdot K'. \ \cos\theta. \ \delta T'.$$

Correcting now our values of the computed velocity for each of the eighteen normal places by an amount representing that due to the third body we have a new set of eighteen observation equations connecting the eight unknowns. In these equations, for sake of homogeneity, we put

$$
\begin{aligned}
x &= \delta\gamma\\
y &= \delta K\\
z &= \frac{100\,K}{(1-e^2)^{\frac{3}{2}}} \cdot \delta\mu \qquad = 13525\cdot67\ \delta\mu\\
u &= K \cdot \delta e\\
v &= \frac{K}{(1-e^2)^{\frac{3}{2}}} \cdot \mu \cdot \delta T \quad = \quad 49\cdot355\ \delta T.\\
w &= K \cdot \delta\omega\\
y' &= \delta K'\\
v' &= \frac{2\pi}{P'} \cdot K' \cdot \delta T' \quad = \quad 2\cdot937\ \delta T'.
\end{aligned}
$$

There result the following normal equations:—

$$
\begin{array}{rrrrrrrrrl}
40{\cdot}000x & +9{\cdot}394y & -16{\cdot}283z & -22{\cdot}704u & +3{\cdot}111v & +0{\cdot}405w & +7{\cdot}526y' & +3{\cdot}349v' & +33{\cdot}400 & =0 \\
 & +15{\cdot}353y & -19{\cdot}924z & -28{\cdot}003u & +3{\cdot}284v & +0{\cdot}016w & +11{\cdot}548y' & +2{\cdot}222v' & +50{\cdot}734 & =0 \\
 & & +176{\cdot}184z & +20{\cdot}361u & -62{\cdot}767v & +43{\cdot}949w & -7{\cdot}554y' & -27{\cdot}991v' & -30{\cdot}492 & =0 \\
 & & & +82{\cdot}772u & -2{\cdot}485v & +0{\cdot}072w & -22{\cdot}165y' & -4{\cdot}273v' & -102{\cdot}683 & =0 \\
 & & & & +24{\cdot}411v & -17{\cdot}105w & -0{\cdot}687y' & +9{\cdot}534v' & -3{\cdot}337 & =0 \\
 & & & & & +17.037w & +2{\cdot}279y' & -10{\cdot}776v' & +9{\cdot}934 & =0 \\
 & & & & & & +20{\cdot}463y' & +1{\cdot}950v' & +54{\cdot}446 & =0 \\
 & & & & & & & +19{\cdot}533v' & -1{\cdot}088 & =0
\end{array}
$$

Whence the following corrections are obtained:—

$$
\begin{array}{ll}
\delta\gamma = -0{\cdot}01 \text{ km.} & \delta T = +{\cdot}030 \text{ days.} \\
\delta K = -1{\cdot}4 \text{ km.} & \delta\omega = +0^\circ{\cdot}12 \\
\delta P = -{\cdot}0017 \text{ days.} & \delta K' = -1{\cdot}3 \text{ km.} \\
\delta e = +{\cdot}007 & \delta T' = +{\cdot}159 \text{ days.}
\end{array}
$$

The resulting values of the elements with their probable errors, as determined at a later stage, are:

$$
\left.
\begin{array}{lll}
P = & 17{\cdot}114 \text{ days} & \pm\ {\cdot}008 \text{ days} \\
e = & 0{\cdot}698 & \pm\ {\cdot}017 \\
\omega = & 25^\circ{\cdot}39 & \pm\ 2^\circ{\cdot}45 \\
T = & \text{J. D. } 2{,}417{,}731{\cdot}464 & \pm\ {\cdot}092 \text{ days.} \\
K = & 49{\cdot}7 \text{ km.} & \pm\ 3{\cdot}31 \text{ km.} \\
\gamma = & -25{\cdot}91 \text{ km.} & \pm\ 0{\cdot}66 \text{ km.} \\
T' = & \text{J. D. } 2{,}417{,}732{\cdot}793 & \pm\ {\cdot}349 \text{ days.} \\
K' = & 2{\cdot}7 \text{ km.} & \pm\ 1{\cdot}02 \text{ km.} \\
A = & 81{\cdot}04 \text{ km.} & \\
B = & 18{\cdot}36 \text{ km.} &
\end{array}
\right\}
\begin{array}{l}
\text{First approximation (solution} \\
\text{(with secondary oscillation.)}
\end{array}
$$

The size of the corrections in some of the elements, and the fact that the residuals (computed—observed) as obtained direct were not in all cases in close agreement with those obtained from the differential equation, *i.e.*, by substituting the values of the corrections in the observation equations, made another solution necessary. The values of ω and γ were, however, considered established as the corrections were very small and the remaining six unknowns were, with the last elements as the basis, formed anew into eighteen observation equations. In these equations

$$
\begin{aligned}
y &= \delta K. \\
z &= \frac{100\,K}{(1-e^2)^{\frac{3}{2}}}\,\delta\mu = 13534{\cdot}86\,\delta\mu. \\
u &= K\,.\,\delta e \\
v &= \frac{K}{(1-e^2)^{\frac{3}{2}}}\cdot\mu\,.\,\delta T = 49{\cdot}6906\,\delta T. \\
y' &= \delta K'. \\
v' &= \frac{2\,\pi}{P}\cdot K'.\delta T' = 1{\cdot}9825\,\delta T'.
\end{aligned}
$$

There result the following normal equations:—

$$
\begin{array}{rrrrrrrl}
14{\cdot}733y & -19{\cdot}889z & -28{\cdot}221u & +3{\cdot}499v & +11{\cdot}503y' & +{\cdot}938v' & +1{\cdot}153 & =0 \\
 & +174{\cdot}454z & +23{\cdot}938u & -61{\cdot}517v & -10{\cdot}663y' & -26{\cdot}344v' & +17{\cdot}185 & =0 \\
 & & +87{\cdot}120u & -4{\cdot}059v & -23{\cdot}403y' & -2{\cdot}458v' & +7{\cdot}668 & =0 \\
 & & & +23{\cdot}708v & +{\cdot}794y' & +9{\cdot}359v' & -9{\cdot}616 & =0 \\
 & & & & +21{\cdot}411y' & +1{\cdot}290v' & +1{\cdot}868 & =0 \\
 & & & & & +18{\cdot}584v' & -4{\cdot}992 & =0
\end{array}
$$

Whence the corrections:

$\delta K = -0{\cdot}02$ km. $\delta T = +0{\cdot}039$ days.
$\delta P = -0{\cdot}0022$ days. $\delta K' = -0{\cdot}05$ km.
$\delta e = +0{\cdot}0037$ $\delta T' = +0{\cdot}080$ days.

The corrected values of the elements with their probable errors, as determined at this stage, are:

$$\left.\begin{array}{lll}
P = & 17{\cdot}1121 \text{ days} & \pm\ {\cdot}005 \text{ days} \\
e = & 0{\cdot}6943 & \pm\ {\cdot}013 \\
\omega = & 25^\circ{\cdot}39 & \\
T = & \text{J. D. } 2{,}417{,}731{\cdot}503 & \pm\ {\cdot}070 \text{ days} \\
K = & 49{\cdot}68 \text{ km.} & \pm\ 2{\cdot}28 \text{ km.} \\
\gamma = & -\ 25{\cdot}91 \text{ km.} & \\
T' = & \text{J.D. } 2{,}417{,}732{\cdot}873 & \pm\ {\cdot}416 \text{ days} \\
K' = & 2{\cdot}65 \text{ km.} & \pm\ 0{\cdot}86 \text{ km.} \\
A = & 80{\cdot}84 \text{ km.} & \\
B = & 18{\cdot}52 \text{ km.} &
\end{array}\right\}\ \text{Second approximation (solution with secondary oscillation).}$$

This solution should have been sufficient, but when substituting directly in the observation equations and comparing the residuals with those obtained in the ordinary way, there was one fairly large difference 0·40km., two were 0·30km. and the rest varied between 0·0 and 0·2 km. Furthermore, the probable errors of some of the quantities, particularly K, seemed too large. It was decided then to compute the probable errors corresponding to the previous corrections made. They are collected in the accompanying Table IV.:—

TABLE IV.

SUMMARY OF CORRECTIONS.

Elements.	Preliminary Values.	First Corrected Values.	Second Corrected Values.	Third Corrected Values.
P	17·120 d	17·116 d ± ·008	17·114 d ± ·008	17·112 d ± ·005
e	0·680	0·691 ± ·017	0·698 ± ·017	0·6943 ± ·013
ω	20°	25°·27 ± 2°·1	25°·39 ± 2°·45	
T	J. D. 2417731·30	...731·434 ± 100	...731·464 ± ·092	...731·503 ± ·070
K	49·0 km.	51·1 km. ± 3·20 km.	49·7 km. ± 3·31 km.	49·68 km. ± 2·28 km.
γ	−25·3 km.	−25·9 km. ± 0·64 km.	−25·91 km. ± 0·66 km.	
		Assumed.		
T'		2417732·634	...732·793 ± ·343	...732·873 ± ·416
K'		4·0 km.	2·7 km. ± 1·02 km.	2·65 km. ± 0·86 km.
Σpvv	485 km.	292 km.	251 km.	235 km.

The values for P, γ, T' and K' were now considered determined. The probable errors, especially those in K, did not seem to be as low as they should be. As the probable error in ω in the later determination was larger than in the preceding one, it was thought advisable to take e, ω, T and K and see if by another solution lower probable errors would be had, and a better agreement between the ephemeris and equation.

As before, for the sake of homogeneity, let

$$\begin{aligned}
x &= \delta K \\
y &= K\delta e &&= 49\cdot 68\ \delta e \\
z &= K\delta\omega &&= 49\cdot 68\ \delta\omega \\
u &= \frac{K}{(1-e^2)^{\frac{3}{2}}}\ .\ \mu\delta T &&= 48\cdot 9307\ \delta T.
\end{aligned}$$

And the resulting normal equations are:

$$\begin{aligned}
14{\cdot}480x - 28{\cdot}036y - {\cdot}077z + 3{\cdot}931u - 3{\cdot}236 &= 0 \\
85{\cdot}688y + {\cdot}387z - 3{\cdot}660u + 4{\cdot}604 &= 0 \\
17{\cdot}243z - 17{\cdot}072u - 1{\cdot}533 &= 0 \\
24{\cdot}149u + {\cdot}080 &= 0
\end{aligned}$$

from which corrections result as follows:—

$$\begin{aligned}
\delta K &= +\ 0{\cdot}29\text{km.} \\
\delta e &= +\ 0{\cdot}0009 \\
\delta\omega &= +\ 0^\circ{\cdot}1743 \\
\delta T &= +\ 0{\cdot}0013 \text{ days}
\end{aligned}$$

The final elements, taking into account the secondary oscillation, are then as follows. The Allegheny results as discussed later are, for purposes of comparison, given here:—

	OTTAWA.	ALLEGHENY.
P =	17·112 ± ·005.	17·117 ± ·0042
e =	0·695 ± ·010	0·685 ± ·011
ω =	25°·57 ± 1°·54	17°·53 ± 1°·58
T =	J. D. 2,417,731·504 ± ·024	1907, Aug. 28, ·697 ± ·034 dys.
K =	49·97 km. ± 1·35 km.	44·69 km. ± 1·15 km.
γ =	− 25·91 km. ± 0·66	− 30·10 km.
A =	81·31 km.	73·88 km.
B =	18·63 km.	15·50 km.
$a \sin i$ =	8,452,100 km.	7,665,000 km.
P' =	8·556 days	8·558 days.
T' =	J.D. 2,417,732·873 ± ·416	1907, Sept. 9, ·176 ± ·368 days
=	time when secondary crosses primary from above.	
K =	2·65 km. ± 0·86	2·39 km. ± 0·77 km.
$a' \sin i'$ =	311,800 km.	281,000 km.

Final elements (solution with secondary oscillation.)

What seems peculiar is that the least-square solution diminished the period in each case, although from a comparison of the 1907 and 1908 observations, when plotted the period would seem to be fixed about 17·120 days. The successive approximations in each case decreased the sum of the squares of the residuals, as seen from Table IV. The final approximation gave Σpvv = 238·3km., practically the same as the previous one. The agreement, however, between the equation and ephemeris is much improved, the greatest difference being 0·27km.; the average 0·15km. and the probable errors are much lower. Table V. contains the phases for the normal places, reckoned from periastron with the period finally adopted, 17·112 days; the corresponding velocity with its weight, and the residuals as computed directly.

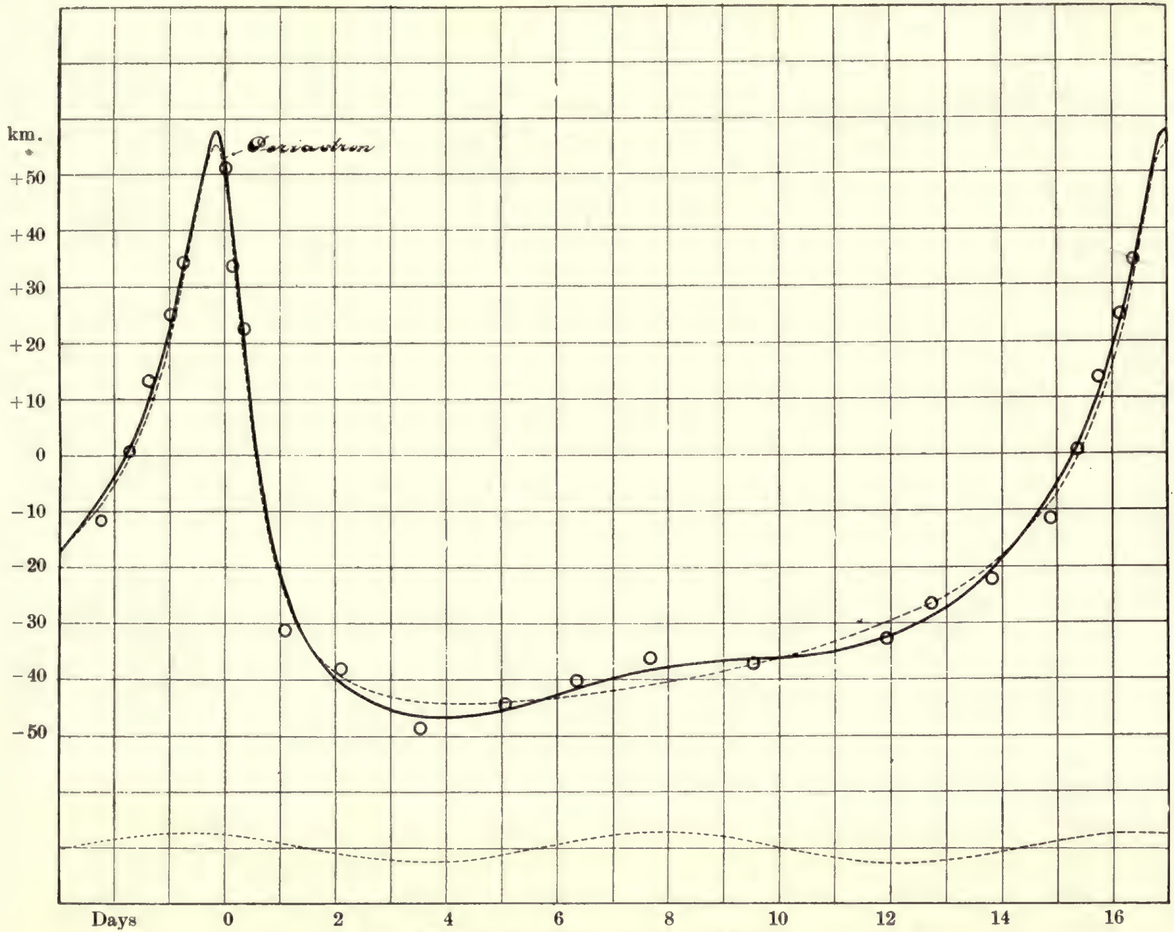


FIG. 17—Final Velocity Curve of θ Aquilæ.

TABLE V.

NORMAL PLACES.

No.	Mean Phase from T	Mean Velocity.	Wt.	Residuals C − O
1..............	13·810	−22·33	3	+1·85
2..............	14·871	−11·75	1	+4·21
3..............	15·378	+ 0·66	3	+0·85
4..............	15·740	+13·33	1	−3·21
5..............	16·143	+24·87	2	−1·55
6..............	16·385	+34·34	3	−0·44
7..............	0·019	+51·00	1	+0·38
8..............	0·166	+33·60	1	+4·75
9..............	0·346	+22·48	3	−3·03
10..............	1·102	−31·31	2	+5·95
11..............	2·107	−38·20	3	−3·16
12..............	3·533	−48·93	2	+1·93
13..............	5·070	−44·50	1	−1·17
14..............	6·357	−40·50	2	−1·53
15..............	7·694	−36·42	2	−2·39
16..............	9·527	−37·38	5	+0·36
17..............	11·932	−33·00	2	+0·07
18..............	12·713	−26·74	3	−2·31

The curve representing the final elements is shown in Fig. 17, the dotted lines being the velocity curves of the primary and secondary components and the heavy continuous line the resultant of these two. The final solution reduces the quantity Σpvv of the residuals for the normal places from 485 to 238·3. The least-square solutions, with the assumption of a secondary disturbance, seem, therefore, to have materially improved the values of the elements. The probable error of a normal place of weight unity as determined by $r = \pm \cdot 6745 \sqrt{\frac{\Sigma\, pvv}{n - \mu}}$ where n is the number of normal places and μ the number of unknowns is ± 2·75km. The probable error of a plate as derived from the residuals in last column, Table II., which are scaled directly from the curve is for the 1907 observations ± 4·5km., and for those of 1908 ± 3·5km. Grouping the two years together the probable error of a plate is ± 4·0km.

Previous Observations.

There remains a discussion of M. Deslandres' observations of 1901 and 1902. These were tried in connection with our 1907 observations to determine the period more accurately than could be done by using our own alone. The only period which suits Deslandres' observations alone is the one which he suggests, viz., 16·7 days. If the two observations of 1901 were omitted the other observations will give a better curve when a period of 17·112 days is used. Fig. 18 shows Deslandres' observations using his period of 16·7 days. Fig. 19 shows his 1902 observations using our period of 17·112 days. He suggested an eccentricity of about 0·6; such a value for e with K = 45 km. and ω = 27°, gives a curve represented by the broken line in Fig. 18, while a similar value for K and ω, with an eccentricity 0·4 is represented in the continuous curve and appears to suit the observations as well as, if not better, than the other. The velocities he gives as relative only; I have added 14 km. to each to bring them into agreement with the general run of mine.

As his measures depended upon one line only, λ 4481, and among themselves gave a more or less uncertain determination of the elements, I decided in my preliminary determination to confine myself to our own observations. Now that a definite solution has been secured, it is well to look at them anew. For convenience the data is repro-

duced here, the tenth of a day being assumed. As stated before, 14km. is added to each velocity determination. The phase with the period 16·7 days is reckoned from the date of first observation of 1902, being Julian Day 2,417,964·4, the phase with the period 17·112 days is reckoned from my own periastron time.

M. DESLANDRES' OBSERVATIONS.

Julian Date.	Phase $P = 16 \cdot 7$.	Phase $P = 17 \cdot 112$	Velocity.
2,415,568·5	4·7	10·221	+ 11
583·5	3·0	8·109	+ 34
964·4	0·0	12·545	− 2
969·4	5·0	0·433	− 36
971·4	7·0	2·433	− 46
982·4	1·3	13·433	− 6
989·4	8·3	3·321	− 40
2,416,010·4	12·6	7·209	− 39
011·4	13·6	8·209	− 36
012·4	14·6	9·209	− 43
015·4	0·9	12·209	− 25
020·4	5·9	0·097	− 22
029·3	14·8	8·997	− 31(?
040·3	9·1	2·885	− 46(?
047·3	16·1	9·885	− 24
048·3	0·4	10·885	− 7
052·3	4·4	14·885	+ 39
054·3	6·4	16·885	− 44
057·3	9·4	2·773	− 48
069·3	4·7	14·773	+ 10
071·3	6·7	16·773	− 26
072·3	7·7	0·661	− 50
076·3	11·7	4·661	− 47
086·3	5·0	14·661	+ 2
088·3	7·0	16·661	− 15
2,416,095·3	14·0	6·549	− 54

It is rather hard to say how best to make use of these early observations. Though the measures are liable to accidental errors of considerable magnitude they may, owing to the interval of some six years which has elapsed between the two series of observations, have an important bearing on whether or not any changes in the elements have taken place during that time. Our 1908 observations seemed to be slightly greater positive than the velocities for 1907 for the corresponding phase. This may have been accidental, the difference being at most less than 2 km. If the absolute velocities of Deslandres' observations were known, it would decide whether the velocity of the system has been changing or not during these six years.

If his two observations of the year 1901 are as they appear in his paper, we must conclude that the period has been changing during the interval. If we omit these two and use the remaining twenty-four of 1902 with our elements we get what appears on the face of it to be a much better agreement of the observations with the curve. There is one discrepancy. The observations fall short of the curve by a common amount, 1·5 days. The number of periods elapsed between the two epochs is in round numbers 125. By increasing the period $\frac{1 \cdot 5}{125}$ or ·012 days, this would be remedied, but while this value of 17·124 days would not make much difference in Deslandres' observations, the least-square solution in our own shows it to be improbable. Here is a suggestion: Is it not probable that the presence of the third body will cause a rotation of the line of apsides similar to that caused by the sun and moon on the earth? A motion of the apse line in the direction of ω decreasing and at the uniform rate of $\frac{\cdot 012}{17 \cdot 112} \times 360°$ or $0° \cdot 2524$ per period would account for this discrepancy. This motion, if it exists,

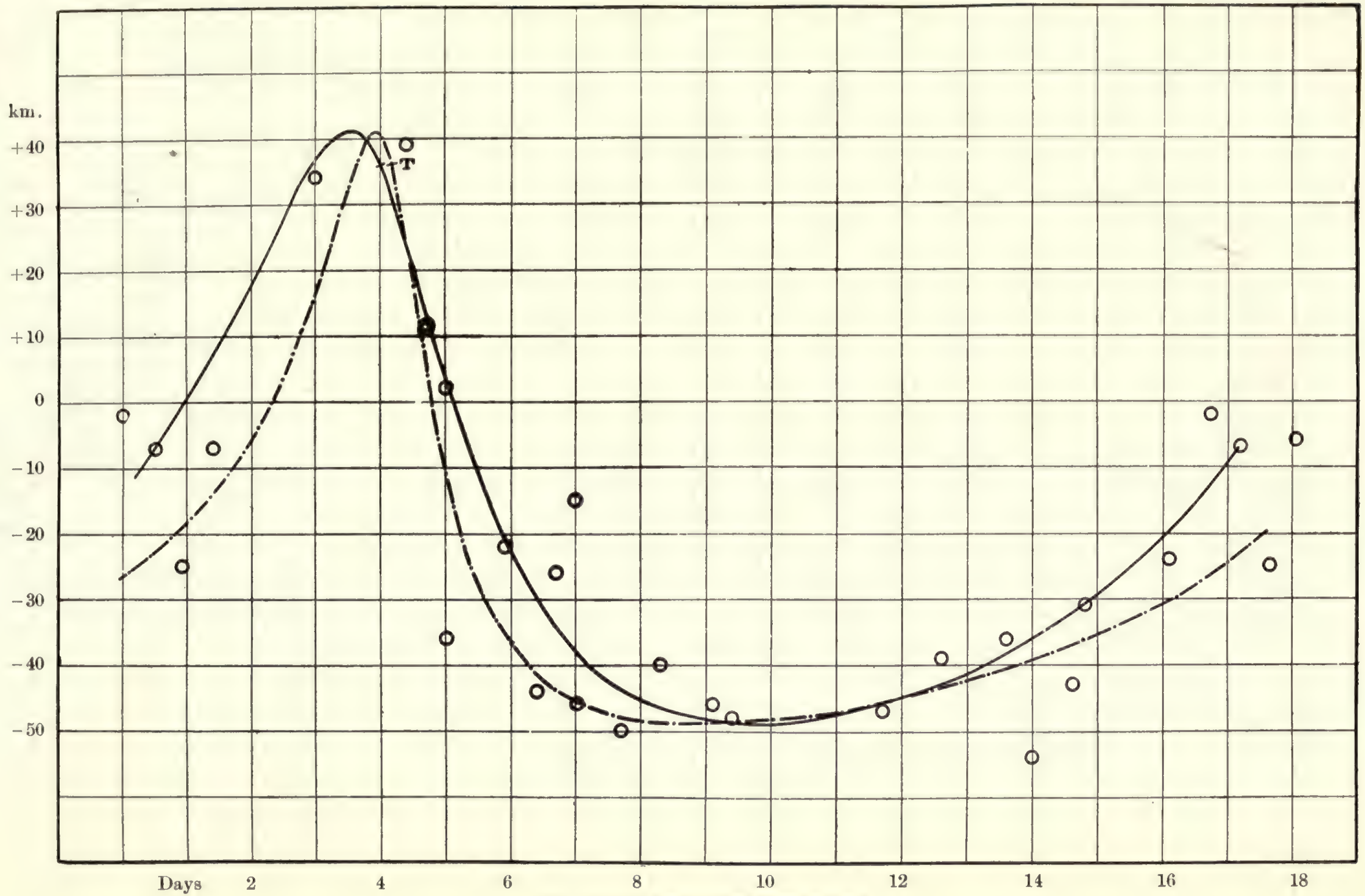


Fig. 18—M. Deslandres' Observations.

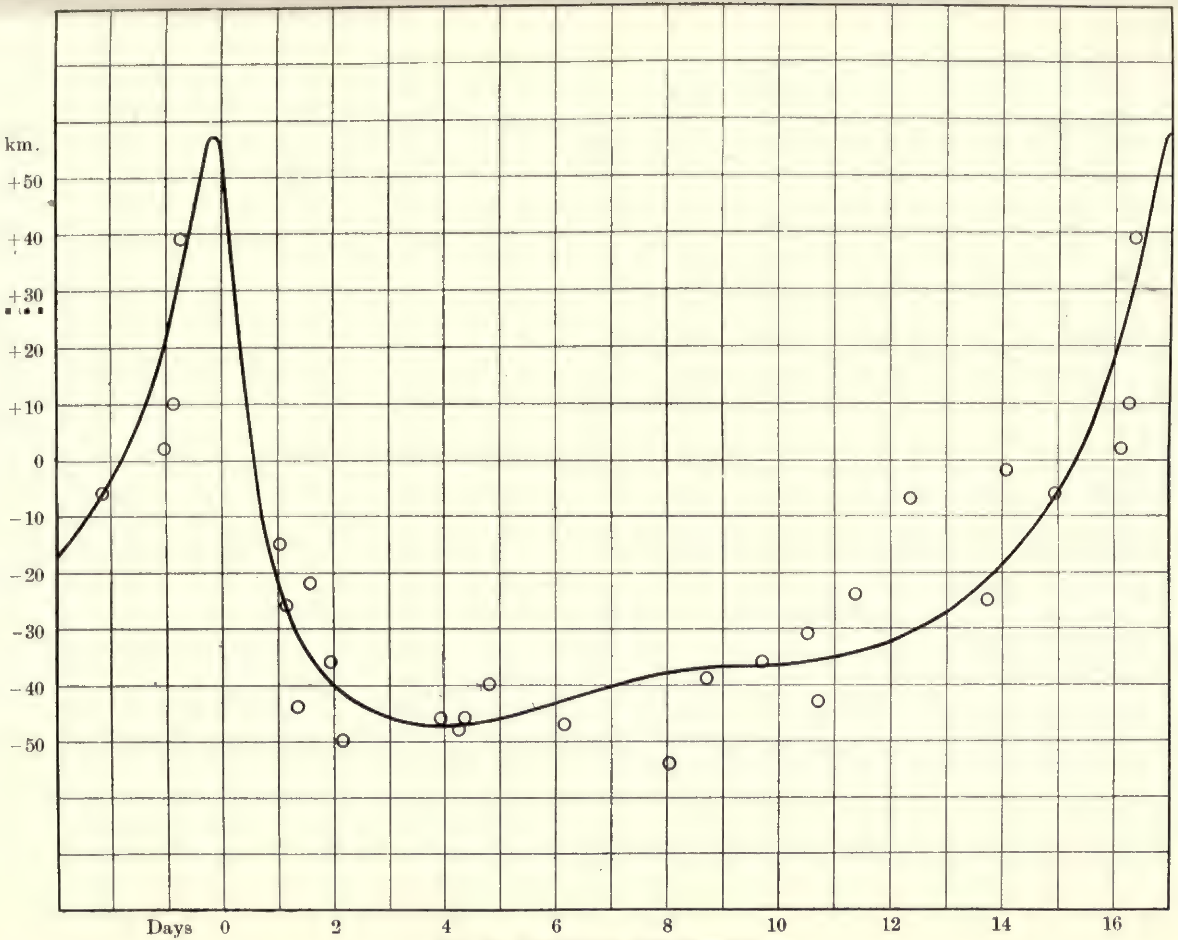


FIG. 19—Deslandres' 1902 Observations.

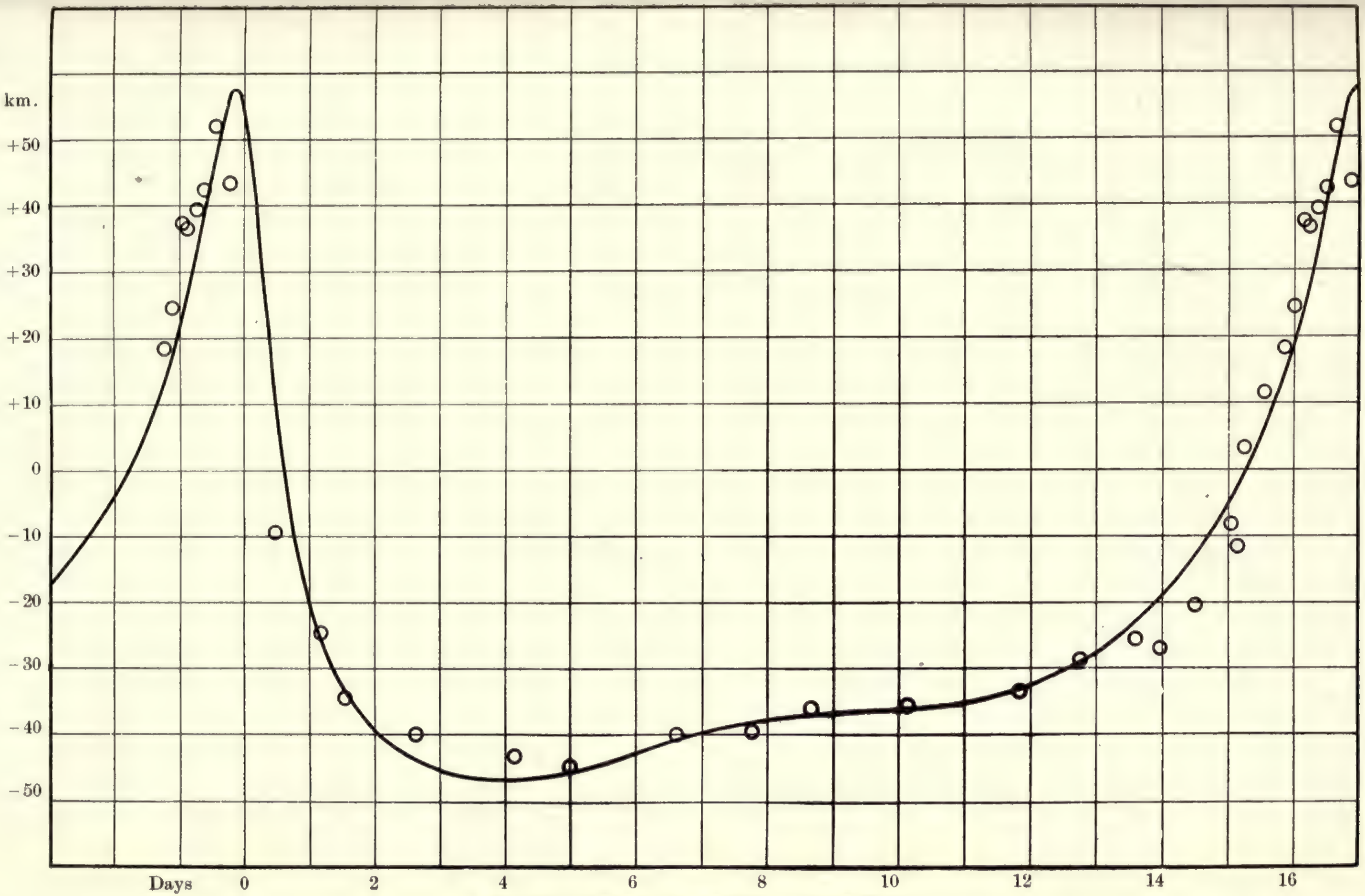


Fig. 20—Allegheny Observations. Ottawa Curve.

would, in addition to decreasing ω and consequently the slope of the curve near periastron, also cause the maximum positive velocity to increase and the maximum negative velocity to decrease numerically.

These questions seem to call for further work on the star at some future time. I do not think the data is sufficient at present to make any definite assertion regarding any change in the elements themselves.

Additional Note on the Allegheny Determination of the Orbit.

Since the foregoing was completed, No. 7 of Vol. I. of the Publications of the Allegheny Observatory has come to hand, containing the orbit of this same star as determined by Mr. Robert H. Baker. It is possibly the first case where two observers, working with different instruments and entirely independent of each other, have completed a discussion of an orbit at about the same time.

A comparison of the results is interesting. In some cases the agreement is remarkable, for instance the secondary oscillation; in other cases the agreement is not what might be expected. Speaking generally, I may say the reason for the differences exists in the observations themselves, the values Mr. Baker has determined suiting his observations best, while the same may be said of our own. There is a gap in the Allegheny observations near periastron passage. The first normal place, phase 0·16 days, depends upon two plates made the same night, the weights of the plates being about one-half the average weight assigned to a plate. The next normal place falls at phase 0·88 days and depends on two plates made on separate nights. These have relatively low weights also. In this interval of 0·7 days additional observations might, and I feel safe in saying, would tend to change the form of the curve. Our observations for phase 0·16 days depend upon one plate made in 1907 and three made in 1908, the plates being a little below the average weight. We have observations, however, for phase 0·34 days depending upon five plates made in 1907 and four made in 1908, the plates being all of average quality, and it is at this point that additional observations would be an advantage to the Allegheny data.

Looking at the results more in detail we see that Mr. Baker's value for γ is about 4km. more negative than ours. The greater positive velocities secured here, account in a measure for this. There may be an explanation also if the velocity of the system be changing, as suggested previously. The bulk of Allegheny observations were made in 1907, while ours are about equally distributed over 1907 and 1908. There is a minor cause in the assumed wave-lengths of the lines used, causing a systematic difference in the two series of velocities. The wave-lengths given in the first part of my report are those at present universally accepted: those given in Mr. Baker's work are sometimes greater, sometimes less, but on the whole would yield a velocity more negative than would those in use here.

The differences are indicated in the accompanying table:—

Line.	Difference in Velocity.	Line.	Difference in Velocity.
λ 4549	− 0·7 km.	λ 4131	− 1·2 km.
4481	− 0·9 "	4128	− 2·4 "
4340	− 1·7 "	3933	+ 2·8 "
4233	− 6·3 "		

On the average a difference of from 1 to 2 km. would be thus accounted for. In certain stars, by examining the trend of the residuals of the various lines and changing their assumed wave-lengths accordingly, a better agreement among the lines themselves can be secured, but unless there are valid reasons therefor it would seem better to retain a constant set of values. Mr. Baker no doubt has good reasons for the change, and the question of absolute velocity is not the most important one.

The probable error of an average plate here is ± 4·0, at Allegheny ± 3·3. The Seed 23 plates used at Allegheny have an advantage over those used here as, being of a finer grain, the spectrum lines would be easier to measure. Our greater number of observations around periastron ought to have much weight, however, in the consideration of the differences between the two results.

The Allegheny observations, with a correction for T to bring the times of periastron passage into coincidence, and the addition of 3 km. to each velocity, being a systematic difference, are plotted in Fig. 20, the curve shown representing the elements as determined here. A glance suffices to show that such a curve does not suit the observations as well as their own curve, and it would seem, therefore, that some further work on the subject would be necessary to explain the discrepancies.

THE SYSTEM OF ϵ HERCULIS.

$$\alpha = 16^h\ 56^m{\cdot}5,\ \delta = 31^\circ\ 4'.$$

This star was announced as a spectroscopic binary by both the Lick and Yerkes astronomers in 1903. The two plates secured at Lick showed both the Mg. and $H\gamma$ lines as broad and diffuse. On the three plates secured at Yerkes, Adams noticed evidences of the composite nature of the spectrum.

Work was commenced on the star here May 24, 1907, and up to the present some one hundred spectrograms have been secured. After quite a number of these had been measured, the period was found to be in the neighbourhood of four days. The observations seemed to group themselves into four sets, showing that the period was very close to the integral number. Thus quite an interval elapsed before observations were secured in the intermediate phases.

When in 1908 the curve was fairly complete an attempt was made to bring up the five early observations so as to determine the period with greater accuracy. The period which suited our 1907 and 1908 observations best was 4·012 days. The early observations, made about the same date in 1903, required an increase in the period of ·0034 days. As the Lick observations were based on the Mg line alone and the Yerkes were for the brighter component and were regarded as provisional only, it was decided to confine our attention to our 1907 and 1908 plates alone.

Keeping the two years separate these were grouped into eighteen normal places. When an attempt was made by the graphical method of Dr. King to obtain preliminary values of the elements it was found that no simple elliptic curve would suit. Having previously found in θ Aquilæ that the assumption of a secondary disturbance due to the presence of a third body would account very well for deviations in the oscillation curve, a similar assumption was made in regard to this star. Here, however, the residuals from the most suitable elliptic curve seemed to repeat themselves thrice in the period of the main star. It was therefore assumed that there was this third body, if so we may speak of it, revolving about the bright star in a period one-third that of its primary, the two in turn revolving about the other component of the system. This was the theory first acted upon.

After a great many trials the set of elements which gave a resultant curve in best agreement with the observations were the following:—

P = 4·012 days
e = ·10
K = 56 km.
ω = 210°
T = J. D. 2,417,721·512
γ = – 28.15 km.
K' = 12 km.
T' = J. D. 2,417,722·162
= time where secondary crosses primary from above.

With these elements a set of eighteen observation equations were formed connecting the eight unknown elements with the residuals. These were transformed into normal equations and the solution gave the following corrections to the elements accepted as preliminary. The new values are also given:—

Elements.	Corrections.	Corrected Values.
P	+ ·00065 days	4·01265 days
e	− ·030	·070
K	+ ·237 km.	56·237 km.
ω	− 18°·35	191°·65
T	− ·178 days	J.D.2417721·334
γ	−1·04 km.	− 29·19 km.
K'	+ ·262 km.	12·262 km.
T'	+ ·015 days	J.D.2417722·177

The new set of elements decidedly improved the agreement as is indicated by a decrease in the sum of the squares of the residuals from 1044 to 715, over thirty per cent. When, however, the residuals were computed directly and compared with those obtained by substitution in the observation equations the differences in most cases were larger than they should be, showing that another solution was necessary. Such a solution has as yet not been made.

Before the work had been carried thus far, observations had been made on the star in 1909. To bring these into agreement with the curve the period would need to be increased to 4·023 days; this period if used would utterly destroy the agreement of the first two years. It seemed then that the period was a varying quantity.

At this stage it was decided to review the plates for evidences of the spectrum of the other component. From time to time in measuring, notes had been made regarding any evidences of duplicity, with corresponding velocities, but now the plates were examined critically with this object in view. Out of the hundred odd plates only six showed the doubling of the lines. Two of them showed $H\gamma$ doubled, two $H\delta$ doubled and two both $H\delta$ and K. The instrument used in almost every case was the single-prism spectrograph which has a dispersion at $H\gamma$ of 30·2 tenth-metres per millimetre. At $H\delta$ the instrument should theoretically resolve lines differing in wave-length by 1·2 tenth-metres. This corresponds to a velocity of 90 km. per second. In practice, however, owing to various causes, a separation corresponding to a much greater difference in velocity would be necessary before the lines could be seen as doubled. The maximum separation found to exist is approximately 160 km. Hence, we can understand how such a small percentage of the plates showed the duplicity of the lines. In the case of these six plates the velocities corresponding to the two components are tabulated in the column of remarks, Table II.

In Vol. I., No. 13 of the Allegheny Publications, which came to hand while the plates were being reviewed, Mr. Robert H. Baker discussed the spectroscopic components of 2 Lacertæ. His blended curve being very similar to that of ϵ Herculis, it seemed possible that the systems might be similar and that his explanation might answer in the case before us. The velocities, while very rough approximations at best, were plotted for each component and elements were obtained for the components as follows:—

Elements.	Brighter component.	Fainter component.
Maximum pos. vel	+ 64 km.	+ 40 km.
Maximum neg. "	−138 "	− 96 "
K	101 "	68 "
e	·15	·15
ω	210°	30°

Physical conditions in the system itself might serve to explain the curious form of the curve, but the two previous theories have much more evidence to support them. The change in the period, if real, would lend strength to the theory of a disturbing satellite. The presence of this third body would tend to cause the line of apsides to rotate, varying the form of the curve and consequently the elements.

Tables I. and II. give all the data of the plates. The residuals for each plate are scaled directly from the curve; the other columns are self-explanatory. Table III. gives the eighteen normal places, the phases being reckoned from the final periastron. The curve, Fig. 21, represents the corrected values of the elements on the assumption of a disturbing body; the dotted lines representing the primary and the secondary, and the heavy continuous one the resultant of the two.

Further work on the star is necessary. Spectrograms of the star at times of maximum velocities are now being secured on plates of fine grain, and it is hoped that some further evidences of the doubling of the lines will thus be secured.

TABLE I.

EARLY OBSERVATIONS OF ε HERCULIS.

Julian Date.	Phase.	Velocity.	Residual.	Observatory.	Remarks.
2,416,235·687	3·046	− 58	....	Yerkes.	....
242·718	2·052	− 43	....	"	....
259·910	3·193	− 70	....	Lick.	Mg. line.
262·827	2·098	− 34	....	"	"
272·664	3·910	− 22	....	Yerkes.	....
616·680	2·837	− 24*	....	Lick.	Mg. line, not very good.
658·849	·867	− 31*	....	"	Mg. line.

* Kindly communicated by Professor Campbell.

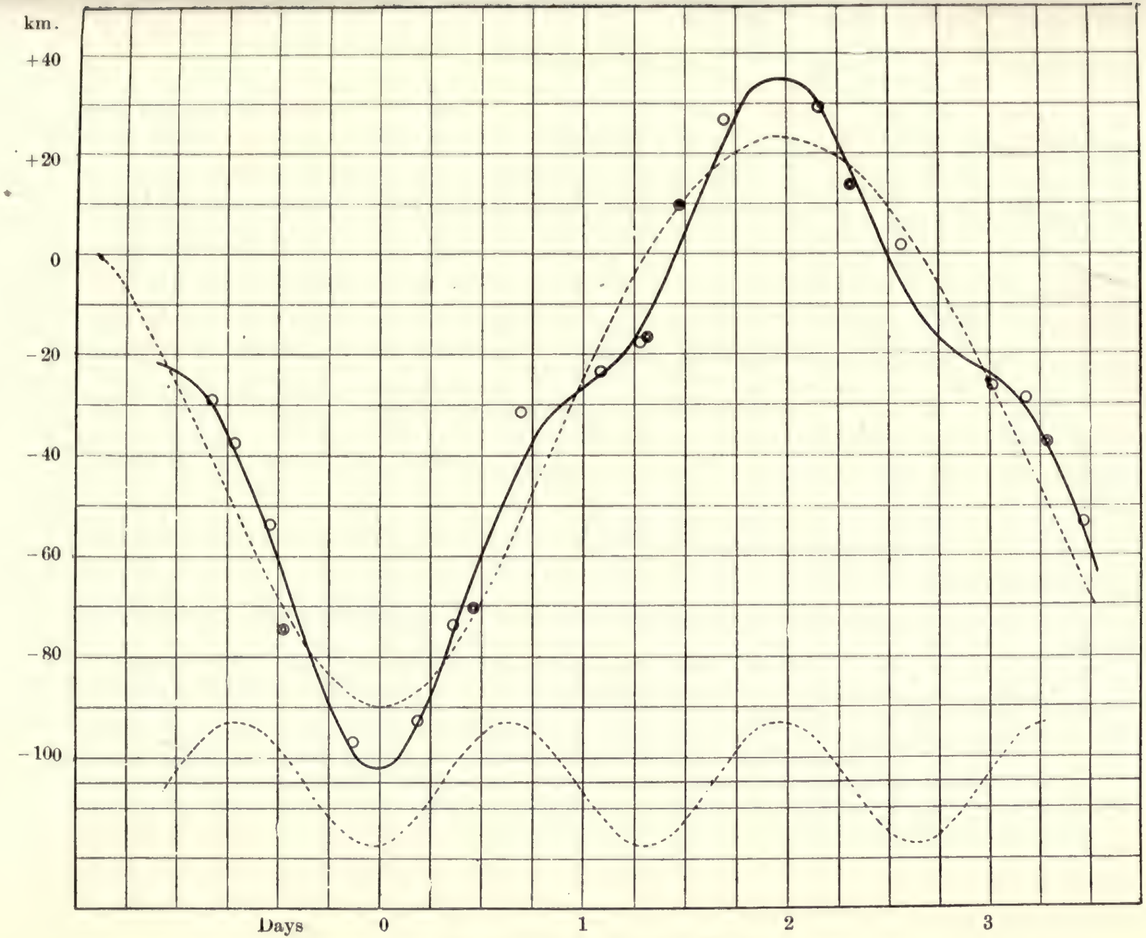


FIG. 21—Velocity Curve of Herculis.

TABLE II.

OTTAWA MEASURES OF ϵ HERCULIS.

No. of Plate.	Julian Date.	Phase.	Velocity.	Wt.	Residual.	Remarks.
	1907.					
786........	2,417,721·767	0·433	−55·6	5	−1·6	
801........	728·735	3·388	−81·4	4	−18·0	
810........	736·812	3·440	−83·7	4	−5·0	
816........	738·741	1·356	+12·7	5	+11·0	
827........	739·652	2·267	+17·8	4	+8·5	
838........	740·774	3·389	−61·7	5	+1·0	Hγ − 128 and − 19
847........	741·767	0·370	−83·2	5	−24·0	
851........	742·738	1·341	+7·0	6	+6·0	
862........	748·692	3·282	−34·5	5	+15·0	Hγ − 111_3 and − 15_2
871........	749·757	0·270	−65·7	5	+5·0	
881........	753·669	0·234	−80·4	3	−6·0	
893........	755·688	2·253	+4·0	3	−7·0	
913........	762·679	1·219	−21·2	2	−11·0	
920........	766·666	1·195	−17·5	7	−6·0	
928........	767·635	2·162	+9·0	5	−10·0	Metallic lines seen.
937........	768·622	3·149	−39·0	4	−2·0	
952........	776·673	3·175	−57·6	4	−18·0	
957........	778·693	1·182	−7·0	7	+6·0	
976........	790·722	1·173	−26·8	5	−12·8	
979........	792·562	3·013	+15·4	6	....	Mg − 125_1 and + 55_3
987........	795·732	2·170	+6·2	3	−12·0	
1018........	811·660	2·048	+30·6	3	+2·6	
1062........	2,417,840·609	2·908	−2·9	2	+22·0	
	1908.					
1391........	2,418,010·868	0·623	−28·6	6	+8·0	
1403........	017·904	3·647	−100·9	6	−9·0	Hδ − 110_1 and + 28_1
1483........	045·900	3·555	−90·7	3	−8·2	λ 4713 gives + 158.
1494........	047·861	1·502	+38·5	7	+22·0	
1511........	054·856	0·472	−37·0	7	+12·4	
1531........	077·813	3·367	−74·0	7	−14·0	
1540........	080·767	2·307	+6·1	6	+1·0	
1545........	082·708	0·236	−74·0	5	+1·5	
1547........	084·770	2·298	−28·5	2	−34·5	
1567........	094·813	0·303	−83·1	3	−14·0	
1573........	096·747	2·237	−11·0	6	−23·5	K intense to red.
1582........	098·778	0·255	−65·6	5	+6·6	
1603........	105·774	3·239	−46·2	4	0·0	
1625........	115·733	1·159	−13·8	5	+0·7	
1630........	117·691	3·117	−31·0	8	+3·5	
1640........	119·710	1·124	+6·1	2	+23·0	Depends on Mg alone.
1648........	120·715	2·129	+24·8	6	+3·4	
1653........	124·676	2·077	+20·0	6	−5·5	
1658........	126·680	0·069	−99·5	3	−7·0	
1661........	126·820	0·208	−86·1	5	−8·7	
1666........	129·730	3·119	−27·0	7	+8·0	
1675........	131·658	1·034	−14·5	6	+6·8	
1676........	131·688	1·064	−22·2	6	−2·2	
1682........	132·716	2·092	+31·2	6	+6·2	λ 4267 gives +128.
1685........	133·609	2·966	−27·9	6	0·0	Hδ − 80 and + 70
1686........	133·649	3·026	−36·0	5	−6·6	K − 14 and + 62.
1693........	134·707	0·071	−108·0	5	−16·0	Metallic lines.
1699........	136·679	2·042	+26·0	4	−2·6	All lines def. on violet.
1707........	137·737	3·100	−43·6	8	−9·6	
1712........	138·708	0·059	−81·1	5	+8·1	
1713........	138·739	0·088	−65·8	6	+24·5	
1719........	139·725	1·075	−13·8	6	+6·0	
1720........	145·708	3·047	−23·7	7	+7·0	
1723........	147·583	0·908	−23·8	9	+2·2	
1728........	148·722	2·047	+23·9	6	+5·9	
1729........	149·707	3·033	−17·6	8	+12·2	
1734........	151·716	1·028	−27·8	5	−6·3	
1737........	152·598	1·911	+34·3	8	−0·5	Hδ − 84 and + 58
1738........	152·631	1·944	+34·7	5	+0·7	K − 115_2 and + 32_3
1743........	152·753	2·066	+40·2	4	+13·2	
1746........	153·712	3·026	−22·3	3	+7·0	
1751........	154·653	3·967	−82·5	5	+11·2	

TABLE II.

OTTAWA MEASURES OF ϵ HERCULIS.—*Continued.*

No. of Plate.	Julian Date.	Phase.	Velocity.	Wt.	Residual.	Remarks.
	1908.					
1757........	2,418,154·795	0·096	−94·3	5	− 4·8	
1760........	155·701	1·001	−22·1	3	+ 0·4	
1761........	159·586	0·873	−28·6	8	− 2·2	
1774........	161·649	2·937	−24·0	7	+ 2·5	
1782........	169·701	2·964	−35·0	7	− 8·7	
1793........	173·612	2·862	−47·8	5	−14·1	
1818........	178·585	3·843	−92·4	7	+ 4·2	
1838........	181·660	2·904	−24·0	7	0·0	
1844........	182·588	3·811	−98·9	8	− 2·8	
1853........	185·578	2·790	− 6·1	5	+16·0	
1866........	189·604	2·804	−20·1	4	+ 2·0	
1903........	216·550	1·660	+11·2	4	−19·0	
1905........	217·516	2·627	+21·0	5	+37·8	
1906........	217·556	2·667	−10·0	5	+ 8·0	
1917........	220·531	1·628	+18·1	2	− 9·1	
1926........	227·593	0·665	−26·8	4	+ 8·3	
1961........	259·440	0·411	−70·3	4	−14·2	
1983........	272·422	1·356	−30·9	5	−33·0	
1993........	278·461	3·382	−30·0	5	+29·0	
	1909.					
2263........	2,418,346·923	3·629	−43·5	.....	....	
2264........	346·958	3·664	−39·3	.....	....	
2305........	360·899	1·554	−18·3	.....	....	
2306........	360·942	1·597	−16·4	.....	....	
2327........	369·883	2·512	+49·5	.....	....	
2328........	369·935	2·564	+12·5	.....	....	
2370........	379·788	0·379	−78·0	.....	....	
2371........	379·808	0·399	−54·3	.....	....	
2384........	381·814	2·405	+36·4	.....	....	
2385........	381·833	2·424	+38·4	.....	....	
2454........	397·836	2·376	+30·0	.....	....	
2455........	397·861	2·401	+29·8	.....	....	

TABLE III.

NORMAL PLACES.

No.	Phase from T.	Mean Velocity.	Weight.	Residual O − C.
1..............................	0·337	−70·22	2	− 6·72
2..............................	1·187	−16·57	2	− 4·00
3..............................	1·348	+ 9·59	1	+ 8·65
4..............................	2·183	+13·26	2	− 4·34
5..............................	3·168	−37·65	2	+ 0·46
6..............................	3·404	−74·53	1	−11·49
7..............................	0·571	−31·63	1·5	+ 9·40
8..............................	0·952	−23·75	3·5	+ 0·67
9..............................	1·152	−17·80	3	− 2·87
10..............................	1·570	+26·96	1	+ 4·53
11..............................	2·034	+29·16	5	− 0·23
12..............................	2·442	+ 1·16	2	+ 6·97
13..............................	2·889	−26·60	4	− 2·61
14..............................	3·062	−28·98	5·5	+ 1·78
15..............................	3·340	−53·30	1·5	+ 2·20
16..............................	3·747	−96·50	2·5	+ 1·45
17..............................	0·048	−92·52	2·5	+ 1·26
18..............................	0·235	−73·35	3	+ 1·84

THE SPECTROSCOPIC BINARY η BOÖTIS.

This star ($\alpha = 13^h\ 49^m \cdot 9$, $\delta = +18° 54'$, photographic magnitude 3·8) was announced as a spectroscopic binary by Moore in L. O. B. 70, 1905. The thirteen measures given extended over the years 1897, 1899, 1901, 1903, 1904 and 1905. Of these, four were approximate, the remaining nine definite. Besides these measures there were available the recently published measures*, six in all, by Kustner of the Bonn Observatory.

Work was commenced on the star here June 25, 1906, and from that time until the date of the last plate mentioned, March 20, 1909, forty-five plates were secured. The determination of the orbit depends then on these sixty-four plates, thirteen of the Lick Observatory, six of the Bonn and the remaining forty-five of our own.

Some objection might be taken to the grouping of observations from different observatories in view of the possibility of a systematic difference in the results used, but it has been deemed expedient by the writer to use these early observations in conjunction with our own to make a preliminary determination of the orbit. Meanwhile plates of the star in the required phases will continue to be made with the new three-prism spectrograph, and when all phases are complete, which cannot be before January, 1910, a new determination of the elements will be made using our three-prism plates alone. The comparison of results ought to be worth the extra labour involved.

The star is of solar type, XIV*a* according to Miss Maury's grouping, and thus permits of accurate velocity determination. As a rule about fifteen lines were measured on each plate. The plates up to No. 752 were made with the Universal spectroscope, and were reduced by means of the Hartmann interpolation formula. From that time the plates were made with either the new single or the three-prism spectrograph, and were reduced from tables used here in which the micrometer settings for zero displacement of the lines are tabulated. Eleven were made with the former, twenty-one with the latter. The plates used were Seed 27. Our own plates made at the commencement of our work are weighted one-half; later plates with the Universal spectroscope, the single-prism plates, most of those made at Bonn, as well as those of 1897 and 1899 made at Lick, are weighted unity, while the later plates of Lick Observatory and our own new three-prism plates are weighted three.

The following tables contain all the data of the plates. The phases are reckoned from the period and periastron finally adopted and the residuals are scaled directly from the curve representing the final elements:—

OBSERVATIONS AT LICK OBSERVATORY.

Julian Date.	Phase.	Velocity.	Weight.	Residual.
413,959·8	192·9	− 0·6	1	−0·4
4,035·7	268·8	− 2·	1	+2·3
4,036·7	269·8	− 4·	1	+0·3
4,057·6	290·8	− 2·	1	+3·4
4,693·8	431·6	− 2·2	1	+3·4
5,524·6	271·7	− 4·9	3	−0·4
6,259·6	16·1	+ 6·9	3	−0·1
6,542·6	299·1	− 8·2	3	−2·4
6,571·6	328·1	− 4·9	3	+1·9
6,603·6	360·1	− 7·6	3	−0·1
6,646·6	403 1	−10·	3	−2·8
6,658 6	415·1	− 7·3	3	−0·6
6,850·9	112·1	+ 5·5	3	+0·1

* Astrophysical Journal, 27-5-1908.

OBSERVATIONS AT BONN OBSERVATORY.

Julian Date.	Phase.	Velocity.	Weight.	Residual.
2,416,258·4	14·9	+ 7·6	3	+0·7
6,595·5	352·0	− 2·2	1	+5·2
6,608·5	365·0	− 4·2	1	+3·3
6,994·4	255·6	− 3·4	1	+0·4
7,234·7	0·6	+ 6·2	1	+1·5
7,369·4	138 3	+ 3·9	1	+0·4

OTTAWA OBSERVATIONS.

Plate Number.	Julian Date.	Phase.	Velocity.	Wt.	Residual.
308	2,417,387·7	153·6	− 0·2	0.5	− 2·5
313	389·6	155·5	0·0	0·5	− 2·2
318	391·6	157·5	+ 1·8	0·5	− 0·3
326	396·6	162·5	− 1·7	0·5	− 3·4
333	398·6	164·5	− 1·6	0·5	− 3·2
366	429·6	195·5	− 0·4	0·5	0·0
372	431·6	197·5	− 4·7	0·5	− 4·2
657	643·8	409·7	− 5·6	1·0	+ 1·3
670	655·8	421·7	− 6·9	1·0	− 0·6
691	669·7	435·6	−10·2	1·0	− 5·0
731	685·8	451·7	− 3·8	1·0	− 0·5
739	692·7	458·6	− 4·5	1·0	− 2·3
752	703·6	469·5	+ 0·7	1·0	+ 0·9
760	710·7	476·6	− 0·1	3·0	− 1·2
764	716·7	482·6	+ 2·9	3·0	+ 0·7
769-771	718·7	484·6	+ 2·5	2·0	− 0·2
774	719·6	485·5	+ 3·2	1·0	+ 0·4
779	720·6	486·5	+ 0·6	1·0	− 2·4
793	725·7	491·6	+ 5·7	1·0	+ 1·7
797	727·6	493·5	+ 5·1	1.0	+ 0·8
812	737·6	8·1	+ 7·2	1·0	+ 1·4
868	748·6	19·1	+ 5·0	1·0	− 2·4
891	754·6	25·1	+ 5·7	1·0	− 2·3
918	765·6	36·1	+ 6·8	1·0	− 1·8
950	775·6	46·1	+ 5·3	1·0	− 3·5
972	789·6	60·1	+11·4	1·0	+ 2·8
990	795·6	66·1	+ 9·0	3·0	+ 0·6
1231	955·9	226·4	− 3·3	1·0	− 1·1
1294	968·8	239·3	− 3·8	3.0	− 0·9
1307	970·9	241·4	− 3·5	3·0	− 0·4
1332	989·9	260·4	− 5·2	3·0	− 1·2
1357	996·8	267·3	− 7·1	3·0	− 2·7
1446	2,418,031·9	302·4	− 7·5	3·0	− 1·6
1513	066·8	337·3	− 6·7	3·0	+ 0·3
1557	085·7	356·2	− 8·7	3·0	− 1·3
1553	087·7	358·2	− 6·6	3·0	+ 0·8
1621	115·6	386·1	− 6·0	3·0	+ 1·0
1663	129·6	400·1	− 7·4	3·0	− 0·1
1710	138·6	409·1	− 6·8	3·0	+ 0·2
1792	173·5	444·0	− 8·6	3·0	− 4·3
1867	192·5	463·0	− 0·3	3·0	+ 1·2
2115	315·0	90·2	+ 8·6	3·0	+ 1·7
2209	337·8	113·0	+ 5·2	3·0	− 0·2
2283	355·8	131·0	+ 6·0	3·0	+ 2·1
2396	386·7	161·9	+ 2·8	3·0	+ 1·0

The observations when plotted gave a period about 492 days. Using this peric they are combined into twenty-one groups, no group including observations of diffe ent periods. Preliminary elements were determined by the graphical method* of D

* A. J., 27-2-1908.

King and, using these, twenty-one observation equations of the form of Lehmann-Filhés were formed. They were then transformed into the following normal equations, where for sake of homogeneity these substitutions were made:

$$x = \delta\gamma$$
$$y = \delta K$$
$$z = K.\delta e$$
$$u = K.\delta\omega$$
$$v = 1000. \frac{K}{(1-e^2)^{\frac{3}{2}}} \cdot \delta\mu$$
$$w = \mu. \frac{K}{(1-e^2)^{\frac{3}{2}}} \cdot \delta T.$$

The normal equations are:—

$$\begin{array}{l} 116{\cdot}000x - 11{\cdot}974y + 1{\cdot}830z + 19{\cdot}935u - 2{\cdot}354v - 20{\cdot}565w + 6{\cdot}260 = 0 \\ \qquad 54{\cdot}535y - 14{\cdot}444z + 2{\cdot}376u - 13{\cdot}460v - 7{\cdot}212w - 28{\cdot}056 = 0 \\ \qquad\qquad 57{\cdot}796z - 2{\cdot}404u - 4{\cdot}352v + 3{\cdot}883w - 19{\cdot}760 = 0 \\ \qquad\qquad\qquad 59{\cdot}931u - 13{\cdot}104v - 62{\cdot}528w - 4{\cdot}652 = 0 \\ \qquad\qquad\qquad\qquad 45{\cdot}343v + 14{\cdot}515w + 40{\cdot}046 = 0 \\ \qquad\qquad\qquad\qquad\qquad 69{\cdot}129w + 7{\cdot}200 = 0 \end{array}$$

The solution of these equations gave as corrections:

$\delta\gamma = - \cdot 02$ km.
$\delta K = + \cdot 43$ "
$\delta e = + \cdot 050$
$\delta\omega = - 1^\circ{\cdot}025$
$\delta P = + 3{\cdot}32$ days
$\delta T = - .520$ "

The sum of the squares of the residuals for the normal places was reduced from 186·1 to 122·7, and the agreement between equation and ephemeris residuals was considered satisfactory. These are given in the accompanying table of normal places:

NORMAL PLACES.

No.	Mean Phase.	Mean Vel.	Wt.	Residual.	Equation-Ephemeris.
1	255·5	−2·15	4	+1·64	−0·13
2	431·6	−2·20	1	+3·41	−0·08
3	271·7	−4·90	1	−0·33	−0·26
4	15·5	+7·25	6	+0·28	−0·08
5	333·0	−6·90	16	+0·02	−0·56
6	112·1	+5·50	3	+0·11	+0·14
7	255·6	−3·40	1	+0·39	−0·03
8	0·6	+6·20	1	+1·50	−0·13
9	138·3	+3·90	1	+0·45	+0·29
10	435·5	−6·20	5	−0·96	+0·01
11	417·7	−7·60	9	−0·98	−0·01
12	480·8	+1·63	11	−0·21	+0·03
13	463·0	−0·30	3	+1·19	+0·12
14	0·9	+6·00	3	+1·25	−0·04
15	48·1	+7·65	8	−1·17	+0·02
16	111·4	+6·60	9	+1·16	+0·02
17	161·9	+2·80	3	+1·02	0·00
18	169·5	−0·97	3	−2·23	0·00
19	238·4	−3·60	7	−0·70	−0·32
20	276·7	−6·60	9	−1·81	−0·02
21	359·4	−7·00	12	+0·49	−0·06

The probable error of a plate as determined from the last two columns of the table, giving the data of the plates and using the formula $r = \pm \cdot 6745 \sqrt{\frac{\Sigma\, pvv}{\Sigma\, p - 1}}$ is $\pm$ 1·04 km. per second. The curve, Fig. 22, is plotted from the corrected elements given in the following table. These are considered close approximations to the true values until observations in all phases of the star have been secured with the three-prism spectrograph when a final determination will be made:—

ELEMENTS OF ORBIT.

Elements.	Graphical.	Corrected.
Period P	492· days.	495·3 days.
Eccentricity e	0·25	0·300
Longitude of apse ω	300°	298°·98
Half amplitude K	7·8 km.	8·23 km.
Velocity of system γ	−0·57 km.	−0.60 km.
Periastron passage T	J. D. 2417730·0	J. D. 2417729·48
Projection semi-major axis a sin i	....	53,474,000 km.
pvv	186·1	122·7

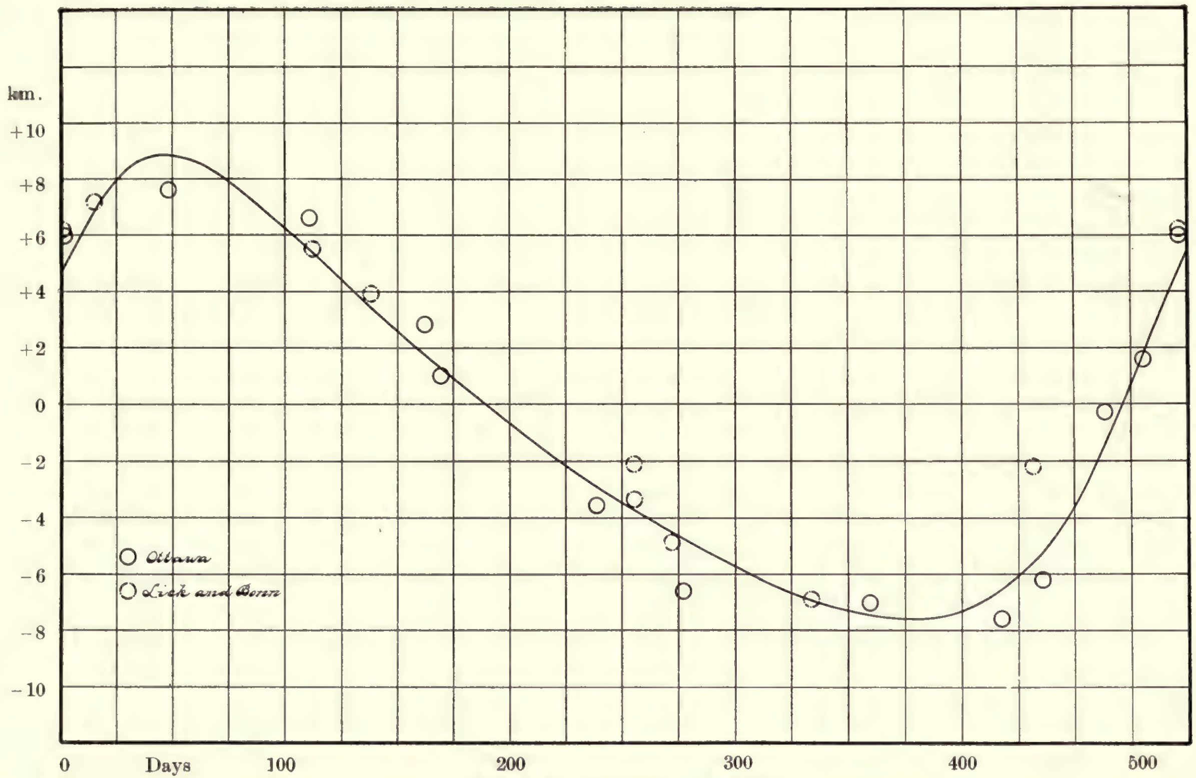


FIG. 22—Velocity Curve of η Boötis.

APPENDIX B.

THE SPECTROSCOPIC BINARY, α CORONÆ BOREALIS.

J. B. Cannon.

The star α Coronæ Borealis ($\alpha = 15^h\ 30^m$; $\delta = +27^\circ\ 3'$), was discovered to be a binary by Hartmann from measures of six plates taken at Potsdam in 1902 and 1903.* It was under observation at this Observatory during the years 1907 and 1908. In all 103 plates were secured, 46 in 1907 and the remaining 57 in 1908; the instrument used being the single-prism spectroscope.

This star belongs to the class I*a* 2 in the Vogel classification. The spectrum shows the dark lines, $H\beta$, $H\gamma$, $H\delta$, $H\epsilon$, the magnesium line λ 4481, the iron line λ 4549, the calcium line λ 3934 and a few other very faint lines. The hydrogen lines are all very broad and diffuse and very difficult of accurate measurement. $H\epsilon$ is so diffuse that it has not been measured at all. The line λ 4481 varies in character, in some plates well defined, in others diffuse. The line λ 4549 is very faint and has only been measured in a very few cases. The line λ 3934 is in general a fairly good line, being weighted about the same as $H\gamma$ and $H\delta$. In the measurement of nearly every plate it was found that the lines λ 4481 and λ 4549 gave entirely different velocities from the *H* lines and *K*. It was decided therefore to consider only $H\beta$, $H\gamma$, $H\delta$ and *K* in the first measurements and the elements determined in this treatment are from the consideration of these alone.

The lines measured, together with the velocities per revolution of the micrometer screw (0·5 pitch), are given in Table I.

TABLE I.

Lines (measured) in α Coronæ Borealis.

Element.	Wave-Length.	Velocity per revolution.
Hydrogen	4861·527	1451
"	4340·634	1044
"	4101·890	868
cium	3933·825	749

These lines vary in quality and were weighted accordingly. The whole plate was then weighted, regard being had, first, to the appearance of the spectrum, and second and more particularly, to the number of lines measured and the agreement in the measurements. The velocities found were plotted successively and gave a period of between seventeen and eighteen days. Trials of several periods ranging between these, gave 17·35 as the most satisfactory. There were available measurements of three plates of 1902 and ten of 1903 taken at Potsdam*, and it was found that on plotting these with the observations obtained here that if the period were increased to 17·355 days, they would, with one exception, lie very close to the curve. Table II. contains

* A. N., 163, 31, 1903.

the number of the plate, the Julian date, the phase—computed from the time of periastron finally accepted, and period 17·355 days,—the weight of the plate, the velocity and the residual between the observed velocity and that computed from the corrected elements.

In order to obtain observations in which the errors might be reduced and a curve drawn showing smaller residuals, the one hundred and three observations were combined into fourteen groups. Plates of both years were combined indiscriminately, those at nearly the same phase being grouped together. The weight of each plate (Table II.) was taken into account and the weighted mean of each group computed, with the mean phase.

(Table III. contains the mean phase from T mean velocity, weight and residual of these normal places.)

TABLE II.

Measures of α Coronæ Borealis.

Plate No.	Year.	Julian Day.	Phase.	Wt.	Velocity.	Residual.
784	1907.	2,417,720·74	13·041	4	−40	+12·5
790	"	725·63	0·576	4	+32	0·
794	"	725·75	0·696	3	+44	−10·
800	"	727·72	2·666	3	+17	+17·
808	"	735·69	10·636	3	−37	+15·
813	"	737·64	12·581	4	−30	+ 3·
830	"	738·74	13·681	2	−26	0·
837	"	739 73	14·671	4	−17	− 3·5
845	"	740·69	15·641	3	− 1	− 8·
850	"	741·69	16·641	4	+11	− 1·5
861	"	747·67	5·266	2	+17	− 4·5
869	"	748·64	6·236	4	+ 9	− 4·5
880	"	752·65	10·246	1	−41	+20·
888	"	753·62	11·216	2	−27	− 3·
892	"	754·64	12·236	4	−28	+ 1·
912	"	761·64	1·876	2	+25	+13·5
917	"	762·64	2·876	3	+30	+ 2·5
919	"	765·65	5·886	3	+ 8	0·
927	"	766·61	6·846	3	− 5	+ 4·5
936	"	767·58	7·816	4	+ 8	−15·
939	"	769·68	9·916	3	−29	−10·
941	"	770·64	10·876	1	−30	− 7·
944	"	773·62	13·851	2	−26	+ 0·5
951	"	775·62	15·851	3	−19	+15·
956	"	777·67	0·546	3	+32	0·
973	"	789·58	11·466	2	−16	− 9·
978	"	791·54	14·421	3	−24	+ 1·5
986	"	794·69	0·216	2	+12	+16·
1060 and 1061	"	839·77	10·386	2	−25	+ 4·
1006	"	800·69	6·216	2	−14	+18·
1014	"	803·63	9·156	2	− 7	− 8·5
1017	"	810·63	16·161	1	−14	+13·
1022	"	811·66	17·151	1	+ 5	+15·
1026	"	815·50	3·676	3	+30	− 4·
1032	"	825·57	13·741	2	−22	− 3·5
1037	"	831·67	2·486	2	+36	− 0·5
1047 and 1048	"	837·53	8·356	3	−15	+ 5·
1083 and 1084	"	850·56	4·016	4	+26	− 2·5
1393	1908.	2,418,010·92	8·186	3	− 5	+ 0·5
1402	"	017·87	15·136	3	−17	+ 1·
1493	"	047·80	10·356	3	− 6	−15·
1571 and 1572	"	096·69	7·181	3	−15	+12·5
1581	"	098·73	9·221	1	− 5	−10·
1601	"	105·71	16·201	3	+ 7	+ 5·5
1608	"	110·58	3.716	3	+ 9	+17·
1623 and 1624	"	115·69	8·831	4	−14	+ 1·
1628 and 1629	"	117·64	10·776	3	−11	− 11·5
1638 and 1639	"	119·66	12·796	4	−21	− 6·5
1646 and 1647	"	120·68	13·816	3	−21	− 4·5
1652	"	124·64	0·421	3	+42	−11·
1656 and 1657	"	126·64	2·421	3	+27	+10·
1655	"	129·70	5·481	3	+12	− 1·

TABLE II.

MEASURES OF α CORONÆ BOREALIS—*Continued.*

Plate No.	Year.	Julian Day.	Phase.	Wt.	Velocity.	Residual.
1673 and 1674	1908.	2,418,131·62	7·401	4	− 3	− 1·5
1683 and 1684	"	133·57	9·351	3	−18	+ 2·
1692	"	134·68	10·461	2	−29	+ 7·5
1697 and 1698	"	136·65	12·431	4	−24	− 3·
1711	"	138·68	14·461	4	−17	+ 5·
1721 and 1722	"	147·54	5·966	6	0	+ 7·
1739	"	152·65	11·076	2	−44	+20·
1748 and 1749	"	154·57	12·996	6	−36	+ 8·5
1764	"	159·64	0·711	4	+37	− 3·
1773 and 1775	"	161·60	2·671	7	+43	− 8·5
1798	"	174·54	15·611	2	−16	+ 6·
1809	"	175·62	16·681	3	− 3	+13·
1816 and 1817	"	178·55	2·266	6	+41	− 4·
1827	"	179·54	3·256	2	+27	+ 2·5
1836	"	181·61	5·326	4	+10	+ 2·
1841 and 1842	"	182·54	6·256	7	+ 8	− 3·5
1852	"	185·56	9·276	2	−15	− 0·5
1861	"	188·53	12·246	4	−30	+ 3·5
1865	"	189·56	13·276	1	−15	−12·
1882 and 1883	"	199·54	5·901	8	+11	− 3·5
1894, '95, '96 and '97	"	204·50	10·861	10	−21	− 2·
1949, 1950 and 1951	"	247·45	1·746	6	+46	− 7·5
1991	"	278·42	15·361	1	+ 8	−20·

TABLE III.

NORMAL PLACES OF α CORONÆ BOREALIS.

No.	Mean Phase.	Mean Velocity.	Wt.	Residual.
1	12·656	− 29·77	6	+ 2·37
2	13·777	− 23·54	2	− 2·34
3	14·664	− 18·50	3	− 2·29
4	15·831	− 5·77	2·5	− 0·36
5	16·723	+ 5·00	1·5	+ 6·22
6	0·556	+ 34·63	4	− 2·17
7	2·302	+ 37·14	6	− 0·71
8	3·559	+ 24·33	3	+ 2·66
9	5·657	+ 11·10	4	− 2·47
10	6·250	+ 2·41	4	+ 1·46
11	7·968	− 6·71	4	− 1·65
12	9·444	− 17·27	2	+ 0·31
13	10·517	− 22·21	3	+ 0·25
14	11·000	− 24·35	3	+ 0·75

From the radial velocity curve the elements of the orbit were determined by the graphic method of Dr. King.* These were:—

P = 17·355 days
T = J. D. 2,417,725·55
K = 33 km.
e = ·28
ω = 309°
γ = 0 km.

* Astro. Journal, Vol. XXVII.

To obtain elements which would give a curve more nearly suiting the normal places, a least-square solution was made. On the advice of Mr. Plaskett, the period 17·355 days was taken as fixed, and the fourteen observation equations (formed by the method of Lehmann-Filhés*) were determined without considering $\delta\mu$. From these the following normal equations result:—

$$\begin{array}{rrrrrl}
+48x - 0{\cdot}4500y & + 3{\cdot}7267z & + 1{\cdot}1799u & + 2{\cdot}8166v & -14{\cdot}1350 & - n = 0 \\
+24{\cdot}0451y & - 7{\cdot}2422z & + {\cdot}4420u & - {\cdot}1050v & - 4{\cdot}1083 & - n = 0 \\
 & +23{\cdot}0108z & - {\cdot}2779u & - {\cdot}8737v & + 3{\cdot}9440 & - n = 0 \\
 & & +19{\cdot}5267u & +17{\cdot}5676v & +63{\cdot}4280 & - n = 0 \\
 & & & +17{\cdot}8291v & +67{\cdot}9099 & - n = 0
\end{array}$$

Where

$$\begin{aligned}
x &= \delta\gamma \\
y &= \delta K \\
z &= K\delta e \\
u &= -K\delta\omega \\
v &= \frac{K\mu\delta T}{(1-e^2)^{\frac{3}{2}}}.
\end{aligned}$$

The solution of the above equations gave the corrections to the element:—

$$\begin{aligned}
\delta\gamma &= + {\cdot}635 \text{ km.} \\
\delta K &= - {\cdot}031 \text{ km.} \\
\delta e &= - {\cdot}015 \\
\delta\omega &= - 3^{\circ}{\cdot}76 \\
\delta T &= - {\cdot}449 \text{ days,}
\end{aligned}$$

and hence the following new elements:—

$$\begin{aligned}
\gamma &= + {\cdot}635 \text{ km.} \\
K &= 32{\cdot}969 \text{ km.} \\
e &= {\cdot}265 \\
\omega &= 305^{\circ}{\cdot}24 \\
T &= 2{,}417{,}725{\cdot}101 \text{ J. D.} \\
P &= 17{\cdot}355 \text{ days.}
\end{aligned}$$

An ephemeris computed with these elements reduces the value of Σpvv from 498·94 to 217·35, but the differences found between these residuals and the observation equation residuals were in some cases rather large, and at a suggestion by Mr. Harper—whom I owe much for other valuable suggestions as well—a second solution was made. This time δK was omitted owing to the small correction obtained in the first solution, and the new observation equations contain only four unknowns, and hence only four normal equations follow:—

$$\begin{array}{rrrrl}
48x + 2{\cdot}0615y & + 1{\cdot}1149z & + 2{\cdot}0989u & +6{\cdot}1200 & - n = 0 \\
+24{\cdot}8703y & + {\cdot}2750z & + {\cdot}3566u & -9{\cdot}4127 & - n = 0 \\
 & +19{\cdot}7284z & +18{\cdot}6666u & -5{\cdot}8754 & - n = 0 \\
 & & +19{\cdot}2174u & -4{\cdot}4691 & - n = 0
\end{array}$$

in which

$$\begin{aligned}
x &= \delta\gamma \\
y &= K\delta e \\
z &= -K\delta\omega \\
u &= \frac{K\mu\delta T}{(1-e^2)^{\frac{3}{2}}}.
\end{aligned}$$

The solution gives the corrections:—

$$\begin{aligned}
\delta\gamma &= - {\cdot}137 \\
\delta e &= + {\cdot}012 \\
\delta\omega &= - 1^{\circ}{\cdot}558 \\
\delta T &= - {\cdot}0475
\end{aligned}$$

* A. N., 136, 17, 1894.

The probable error of a normal place of unit weight was computed and found to be $\pm$ 3·07, that of a plate as determined from the residual for each plate scaled from the curve to be $\pm$ 5·386. The probable error of each element was also computed and is attached to the final values below, the values obtained after applying the corrections found in the second least-squares solution:—

γ = + ·498 km. $\pm$ ·330 km.
K = 32·969 km.
e = ·277 $\pm$ ·0012
ω = 303°·68 $\pm$ 4°·25
T = 2,417,725·054 J. D. $\pm$ ·187
P = 17·355 days
$a \sin i$ = 7,560,000

These values give a second reduction of Σpvv from 217·35 to 207·7 and satisfactory differences between equation and ephemeris residuals, the average being ·08. The curve shown is drawn from the above elements and the circles show the position of the observed normal places.

Since the completion of the foregoing treatment of the binary, from the point of view of the hydrogen lines and the calcium line, λ 3934, all the plates have been reviewed, and the magnesium line λ 4481 carefully measured where measurement was possible, with the intent of determining in what respects the orbit deduced from this line might differ from that already determined from the other lines. The method of treatment was exactly similar to that formerly followed. The period was taken as before—17·355 days. The observations were grouped into normals, the same plates being taken together as in the former treatment and the relative weights assigned as before. The normals were plotted, and the best curve possible drawn through them, or rather the graphic method of Dr. King was employed to obtain the elements of the orbit, the velocity curve corresponding to which best suited these normal places.

The elements thus found were as follows:—

γ = + 6·69 km.
K = 33 km.
e = ·35
P = 17·355 days.
ω = 316°

Comparing these with the corresponding elements from the other lines, the main differences are seen to be in the values of γ and e.

In the work which has been done on the radial velocities of stars other than binary, some stars have been found, certain of whose lines gave consistently different velocities from other lines. Among them is *o* Ceti, the emission and absorption lines giving a considerable difference in the value of the radial velocity; so with nearly all Novæ. Nova Aurigæ has been discussed at some length by several astronomers and a similar phenomenon has been noted. Explanations have been suggested as to the cause of the different displacement of different lines. These consist chiefly of two,—first, a lagging envelope producing the lines of less displacement towards the red end of the spectrum, and second, an ever-expanding envelope coming from a continuously productive source. How far such conditions would go to explain a state of affairs such as we find in α Coronæ, it is difficult to say. We may also look upon the system as receding with a velocity of 6·69 km. per second—the velocity given by the magnesium line—and constantly expelling hydrogen and calcium vapors, the velocity of expulsion affected by the periodic recurrence of physical conditions, brought about by the changing relative positions of the stars in the orbit, which conditions fail to influence magnesium in any way so far as changes in the lines are concerned. This is quite plausible, for in

the spectroscopic study of the Sun's surface, regions have been found, such as sunspots, the spectra of which show certain lines considerably affected in character and position, while other lines denoting other elements remain unchanged.

After the first part of this work had been completed, Mr. Jordan issued from the Allegheny Observatory his publication on the Orbit of α Coronæ Borealis. Comparing his results with those obtained here from the lines $H\beta$, $H\gamma$, $H\delta$ and K, it was seen that, although on the whole they agreed fairly well, there was considerable difference in the values of e. This is largely due no doubt to the fact that Mr. Jordan used the line (Mg) λ 4481, together with the above lines in the determination of his elements. However, the fact that the plates we obtained here were measured by several men and all agreed that the Mg line gave large discrepancies seems to justify the separate treatment.

The accompanying curves represent—Fig. 23, the hydrogen and calcium curve, and Fig. 24 the curve from the hydrogen and calcium lines, and that from the magnesium lines.

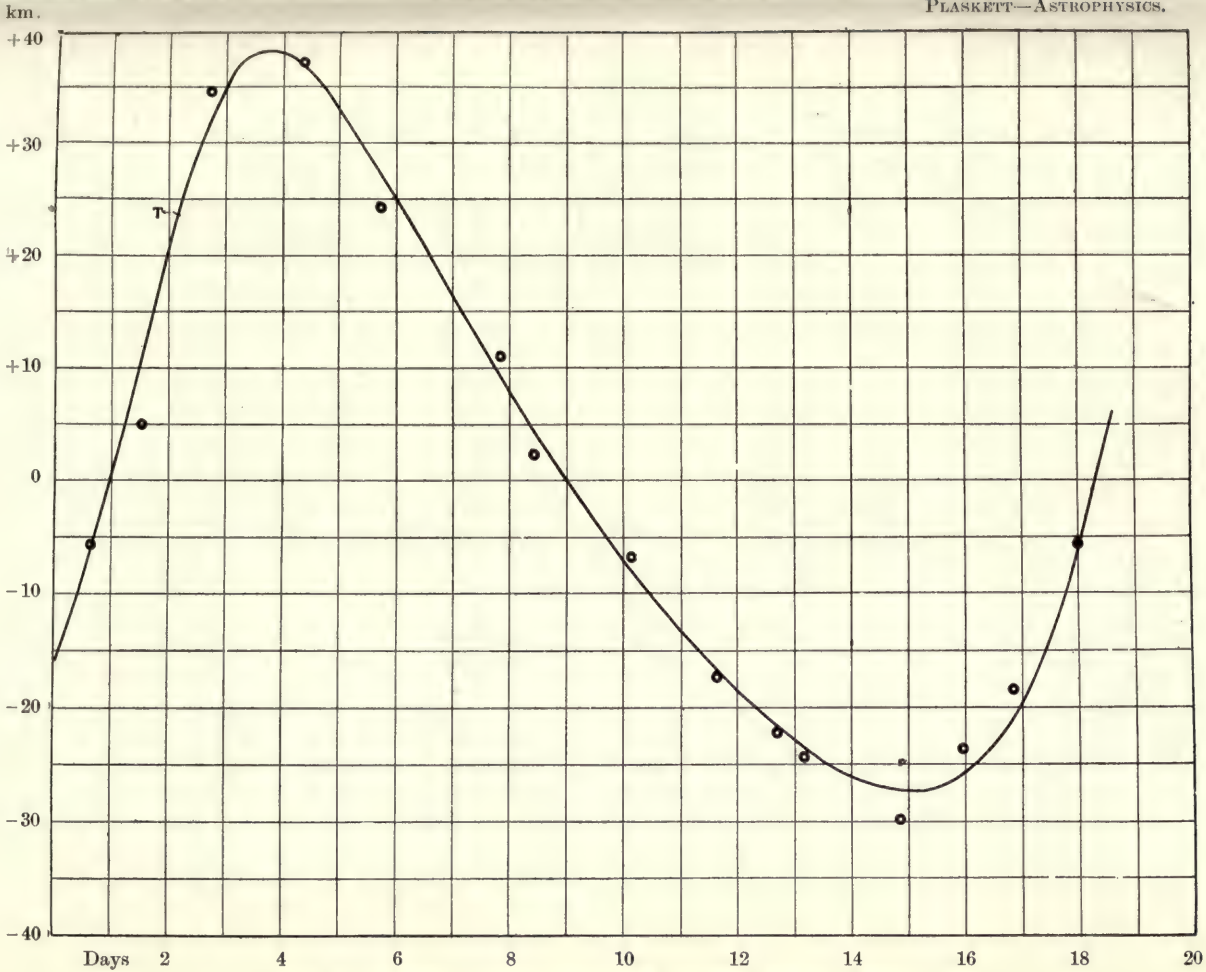


FIG. 23—α Coronæ Borealis, Curve from Hydrogen Lines and Calcium Line.

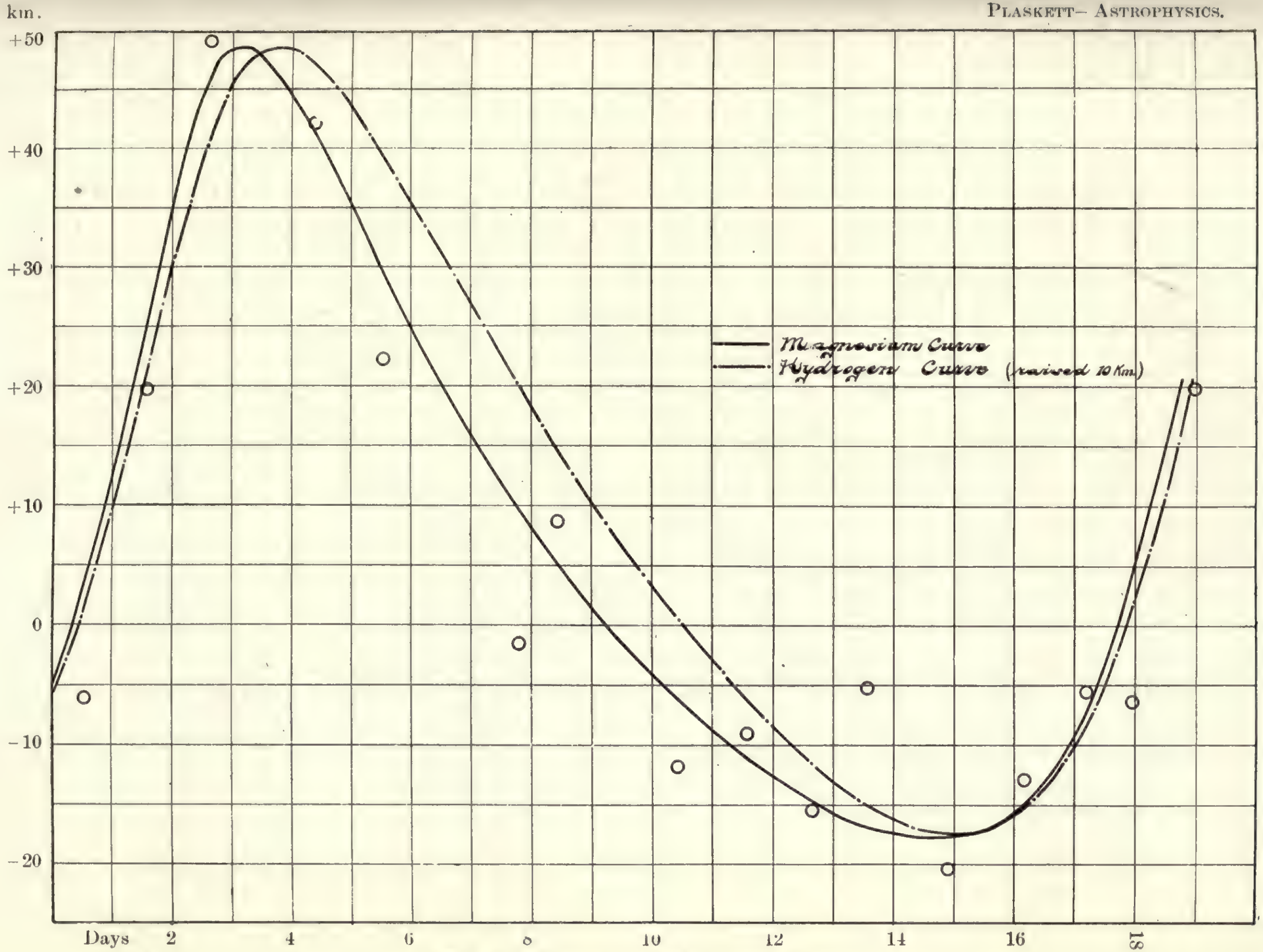


Fig. 24—Velocity Curve of α Coronæ Borealis.

APPENDIX C.

THE TWENTY-THREE FOOT SOLAR SPECTROGRAPH.

RALPH E. DELURY.

This instrument is adapted for analyzing with great dispersion the light of the sun and of laboratory sources, such as the electric spark, arc, flame, &c., and is primarily intended for investigating the conditions in the sun. It is situated in the basement of the Observatory in the Solar Research Room, which is connected on the north side by a cement tunnel to the louvred passage of the Coelostat House from which the image of the sun is directed to the spectrograph, and on the east side to the Chemical Laboratory, which is used also as a photographic dark-room in which are developed the photographs of the spectra taken in the spectrograph. The spectrograph may be described under the following heads:—(*a*) Optical Parts; (*b*) Mountings; (*c*) Slit-Attachment; (*d*) Camera and Plate-Holders; (*e*) Guide-plate for the Sun's Image.

(a) Optical Parts.

The optical parts are:—a slit with metal jaws 1·3 in. (3·4cm.) long, mounted so as to leave 1 in. (2·5 cm.) clear, and provided with a micrometer, for adjusting the width of the slit, reading to thousandths of an inch; a six-inch (15 cm.) collimating lens of 22 ft. 10 in. (695·5 cm.) focal length for yellow light; and one of the earlier Michelson plane gratings of speculum metal having a 4·25 in. by 4·75 in. (10·8 cm. by 12 cm.) surface ruled 12,700 lines to 1 in. (500 lines to 1 mm.). These parts are arranged after the plan described by O. Von Littrow in 1863 (see Kayser Handbuch der Spectroscopie 1, 513). In this arrangement the slit is placed at (or near) the focus of the lens and the dispersing system (in this case the grating) is placed on the other side of the lens in such a manner that the dispersed light returns through the lens which focuses it near the slit, as illustrated in Fig. 25, which represents a vertical section through the middle of the spectrograph and mountings. S is the slit, L the lens, placed at its focal distance from the slit and G is the reflecting grating placed just behind the lens L, and tilted so that its ruled lines are parallel to the slit. The beam of light to be examined passes through S spreading out to fill L, which renders it parallel before it reaches G, which disperses it and reflects or diffracts it back through L. By tilting the top of the grating slightly towards the slit the diffracted light is made to pass back through the lens which focuses it below the slit where it may be examined with an eye-piece or photographed in the plate-holder (C). By rotating G about a vertical axis on either side of the normal, the different parts of the different orders of spectra are diffracted back through the lens L, and by sliding the lens forward or backward the light of the different wave-lengths may be focussed sharply at C.

(b) Mountings.

The two tilting movements of the grating mentioned in (*a*) were provided in the cell of the grating by the John A. Brashear Co., from whom it was purchased. The forward tilt is given by screw J and suitable springs pressing against the back of the grating; and a screw placed on the side gives the means for adjusting the lines of the grating parallel to the slit. The grating in the cell rests on the stand G', the axis of which fits into a cylindrical socket in the bottom of

the end, B, of the spectrograph, and by turning a handle K'' (Fig. 26), attached to a worm which works in the toothed sector, K, which is attached rigidly to the axis of G', the grating may be rotated about this axis which passes through the centre of the plane of the grating, thus reflecting any desired part of the spectrum of any order through the lens to C. By means of the vernier-pointer, V, readings to tenths of a degree may be made on the graduated arc E and a record of these readings with the corresponding wave-lengths of the spectra reflected to C is kept, so that by turning K'' until V points to the proper angle, any desired wave-length may be reflected to the centre of C and the grating may be clamped in this position by tightening the screw-clamp K'. The lens may be shifted and clamped at any focus by means of the handle H, and the position of the pointer F is read on a millimetre scale attached to the bottom of B, as shown in Fig. 26. Ordinarily the side represented in Fig. 26 is facing downwards and a mirror is placed below the scale and the arc so that the reading may be made conveniently. In addition to these movements of the grating and lens, the mountings permit of rotation of the spectrograph as a whole about its axis, *i.e.*, about the line joining the centre of the slit and the centre of the lens. This idea was suggested by Mr. Plaskett (Report Chief Astronomer for the year ending March 31, 1907, p. 58) and employed by Newall (Monthly Notices 68, 7, Nov., 1907), and used also in the spectrograph mounted vertically and used with the vertical telescope of the Mount Wilson Solar Observatory. It facilitates the study of the rotation of the sun, by enabling the observer to reflect the limbs of the sun at opposite ends of any diameter always tangentially to the slit, as described in detail under (*c*), in Fig. 25, A and B are the two ends resting on the supports A' and B' which rest on the cement piers P and P' built on the cement floor. The end A is of half-inch cast brass. It has a V-groove running around its circular rim into which the semi-circular cast-iron support A' is bevelled to fit. The back of A is a rectangular box 3 in. by 11 in. by 14 in., over which the wooden box O is tightly screwed and clamped. The axis of B, which is of cast-iron, rests in a cylindrical bearing in the brass support B'. The box on B projects 3 in. on top and 16 in. on the sides and bottom to give good support for the lens and grating and to provide a surface to which the box O is screwed tightly. The bottom of B is milled smooth to give easy bearings for the grating and lens mountings. The box O is painted black on the inside and is provided with diaphragms, M, to prevent as much as possible the diffused light reflected from the lens and grating from striking the photographic plate in the holder, C. There is a hinged door, D, just above the grating and lens so that these may be conveniently reached.

The spectrograph thus rests at its two ends on the supports A' and B' on which it may be rotated about its axis. The rim of A is toothed (T, Fig. 25) and into these teeth fits a gear attached to T'' (Fig. 27), which is supported in A' and which may be turned by means of the handle T' (Figs. 27 and 28). The circular face of A is graduated in degrees and by means of the vernier attached to A' the angle may be read to tenths of degrees. This is necessary in determining the 'East and West' line by allowing the image of the sun to drift across the face of A tangentially to some arbitrary line on A. From this angle read on the vernier, the position of the diameter of the sun's disc which lies in the plane of the sun's equator, is easily found since the inclination of these two lines to each other at any time is known, and hence the arbitrary line on A may be made parallel to any required diameter of the sun's image.

The mountings were constructed by the Victoria Foundry Co. from designs made in accordance with the suggestions of Mr. Plaskett who supervised the construction of the spectrograph. The mechanisms for rotating the grating and the spectrograph were skillfully constructed by Messrs. Mackay and Lucas.

(c) Slit-Attachment.

The slit-attachment is shown in Fig. 27. It was designed by Mr. Plaskett and made by the John A. Brashear Co., *a, b, c, d* are 45° reflecting prisms mounted on

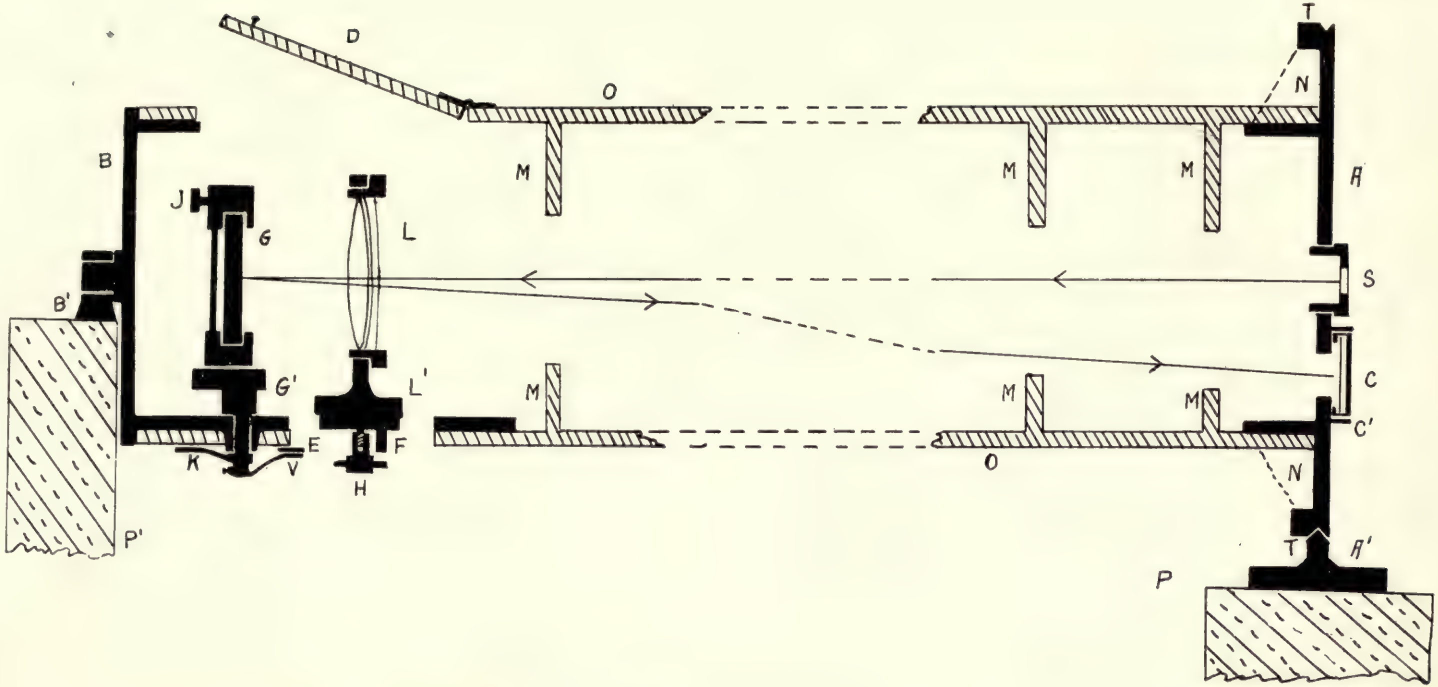


FIG. 25—Solar Spectrograph.

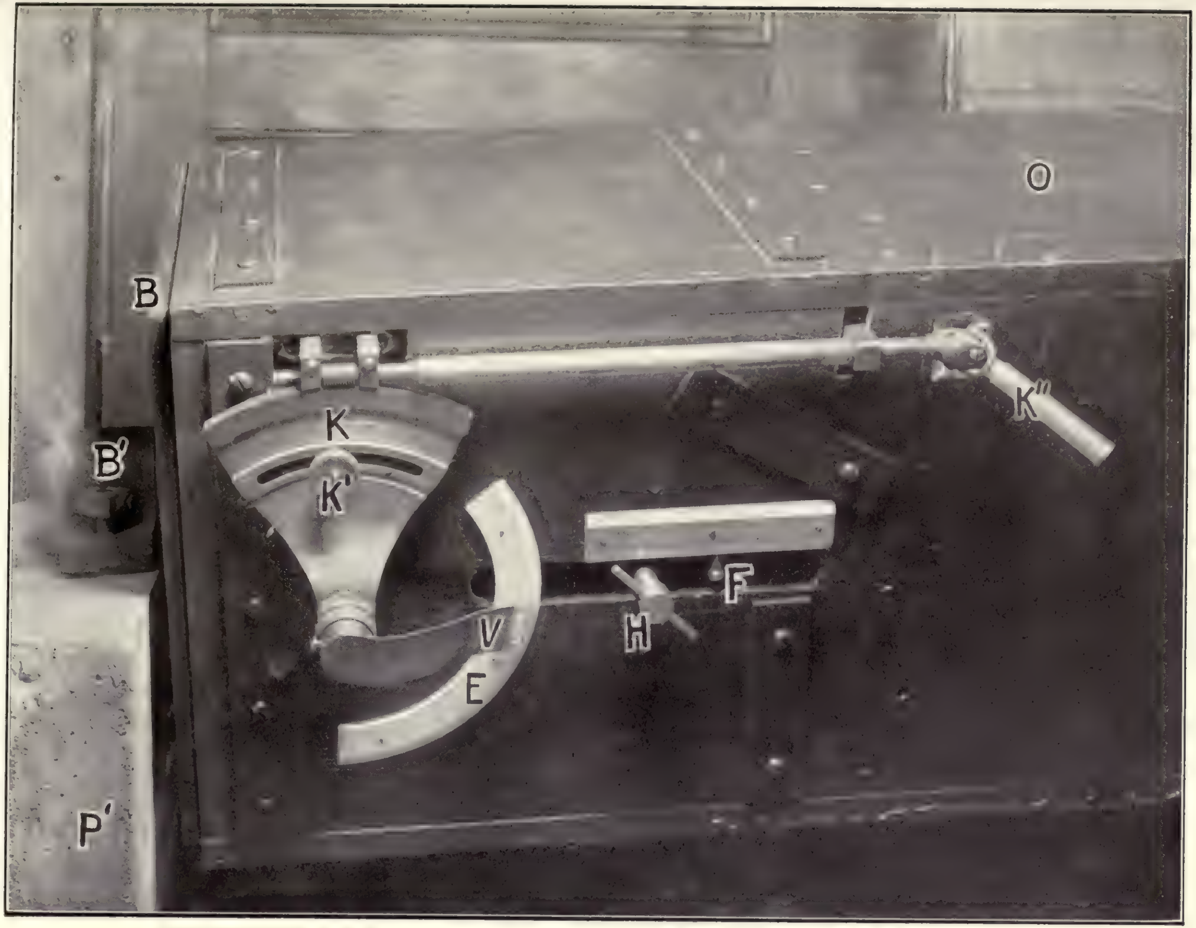


FIG. 26—Rear end of Solar Spectrograph.

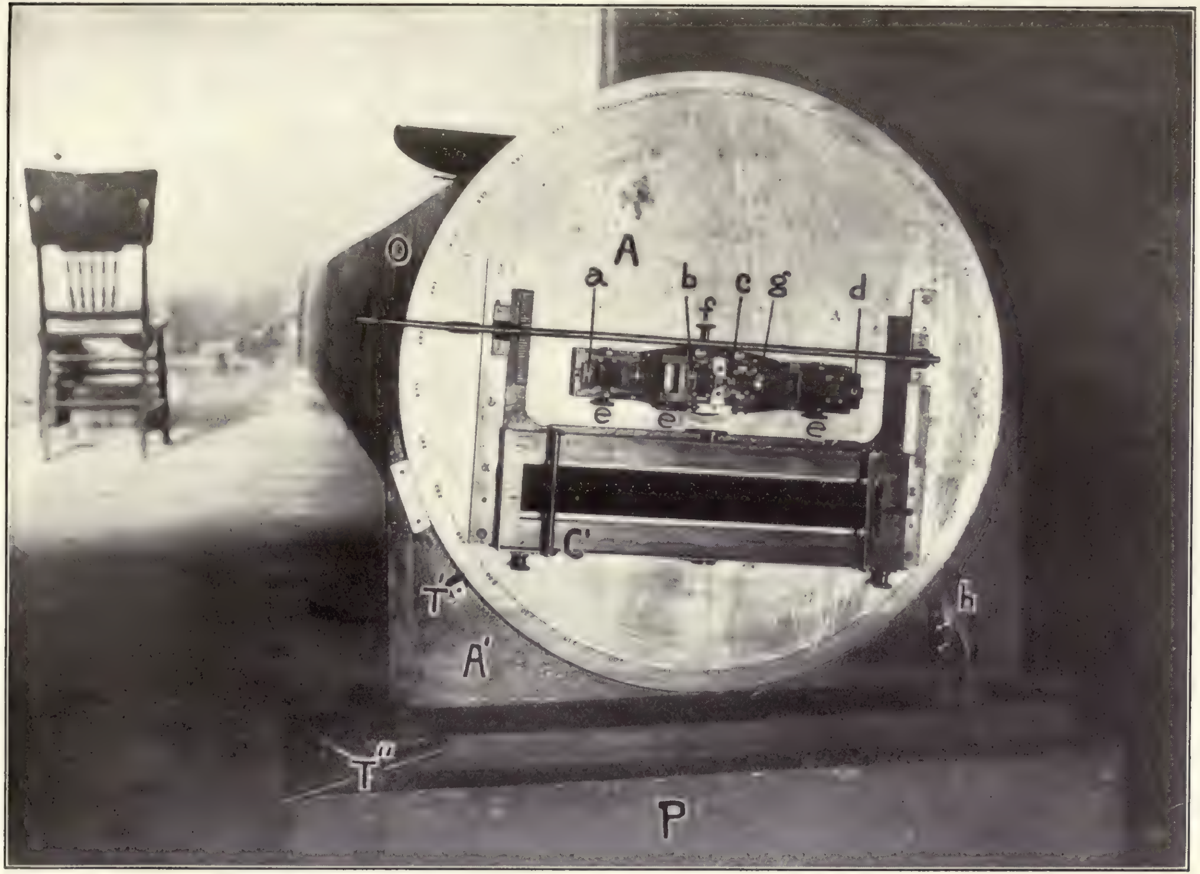


FIG. 27—Slit Mechanism of Solar Spectrograph.

FIG. 28—Front End of Solar Spectrograph.

brass plates which are supplied with racks and pinions *e, e, e*. When the sun's image is placed concentric with the circular front of the spectrograph, the prism *d* is moved to take the light from any desired point near the sun's east limb and reflects it to the prism *c*, which directs it down through the slit to the lens and grating. In a similar way the larger prism, *a*, reflects to the west limb through the prism *b*, whose tapering ends form a V-shaped space into which the tapering end of *c* fits closely, so that the spectrum from the east limb is placed closely between two strips of the spectrum from the west limb. The widths of these strips may be varied by moving the plate holding the prisms *b* and *c* back and forth, and by means of two little slides placed directly over the ends of the slit. When desired the shutter, *f*, may be used to keep the light passing through the slit from reaching the lens. In place of the plate bearing the prisms *b* and *c*, the attachment, *h*, may be used and by means of two adjustable screws which serve as stops between which it may be shifted so that two spectra of any desired widths may be taken in succession, the one being placed between two strips of the other, the V-shaped openings and the V-shaped slides providing the means for adjusting the widths of the strips. The prism arrangement is intended for obtaining plates for measuring the rotation of the sun or for any investigations where it is desirable to take the spectra simultaneously, while the attachment, *h*, is designed for taking spectra in succession, and of course the time of an exposure will be less in using it than in using the prisms which diminish the intensity of the light considerably.

(d) Camera and Plate-holders.

The plate-holders are made to take a 2·5 in. x 12 in. plate, a hinged back with three springs pressing the back of the plate at its edges holding the plate firmly in place without danger of bending it. The plate-holder, *C*, Fig. 28, is slid into the frame *C′*, Fig. 27, and clamped, as shown in Fig. 28. The frame *C′* can be raised or lowered by rack and pinion as shown, so that several strips of spectra may be put side by side on the same plate, and spaced as desired by reference to the millimetre scale on the right hand side. The plate-holder fits over a 1·5 in. opening in *A*, Fig. 27. The frame *C′* may be tilted slightly so that the plane of the photographic plate may be made to follow more closely the focal surface of the lens.

(e) Guide-plate for the Sun's Image.

In Fig. 28 is shown the guide-plate *R*, screwed tightly over the slit-attachment. *R* has a number of concentric circles and a diameter scratched on its surface and blackened so as to be easily visible. These circles are concentric with the circular front of the end-piece *A*. The figure shows the sun's image placed concentric with these circles. At each end of the diameter of these circles is a small rectangular opening, back of which is a little slotted silver-plated shutter which runs in bevelled slides. These shutters may be adjusted by means of the millimetre scales on the edges of the two rectangular openings, so that the slots are tangential to the same circle whose diameter is read off directly, the distance between the nearest ends of the rectangular openings being 200 mm. In the same manner the diameter of the solar image is measured. Back of these slots the prisms are adjusted to give the maximum brightness in the light reflected from the grating, and thus the spectrum from a point in the image near one limit may be placed between two strips of the spectrum from a part of the image at the other end of the diameter. To get any desired latitude on the sun's disc, the image is allowed to drift across the guide-plate tangentially to the diameter—the arbitrary line mentioned above—scratched on the plate and the vernier reading taken of the angle corresponding to this 'east and west line' which makes a known angle at any time with the sun's equator. The handle *T″* is then turned to place the diameter in the desired position. One slit will thus be placed at a certain latitude north of the

sun's equator and the other at the same latitude south of the equator, and the displacement of the spectral lines resulting therefrom will give a measure of the rotation of the sun in this latitude by turning T'' so that the slits are placed at the same latitude, but on the opposite sides of the equator to those of the former position the same displacement should result if: (1) the sun's equator has been accurately determined, (2) the image in both cases is concentric with the circles on the guide-plate, and (3) the rotation of the sun is the same for the same latitude in both hemispheres. Taking the mean of the two measures from plates taken in succession would eliminate most of the errors introduced.

SOME RESULTS.

The spectrograph was mounted in August, 1908. The cement piers, P, P' (Figs. 26, 27, 28), are made so as to make the axis of the spectrograph coincident with the axis of the concave mirror in the coelostat house, when the image from it is placed in the middle of the face, A, of the spectrograph, P being a few inches higher than P', giving the proper inclination (about 3½°). The spectrograph was adjusted and numerous test photographs were taken in the various parts from λ 3800 to λ 6000. To keep the light reflected back from the surfaces of the lenses from striking the photographic plate the ordinary method of putting a strip across the lens, parallel to the plate, was tried; also, in some tests, the lens was tilted forward so as to throw the reflected light below the photographic plate. This latter method does not alter the character of the lines very much and possesses the advantage of doing away with the strip which masks the central part of the grating and lens. It was soon found that the character of the spectral lines in the different orders from either the left or right inclinations of the grating was not as good as desired. By directly reflected light the grating appears to have three areas of different reflecting powers and it was found that the spectra from these areas did not harmonize. The best spectra were obtained by masking the two smaller areas and using the remaining strip which constituted the right three-fifths of the grating. Even from this part of the grating the spectral lines are poor. In the first and second orders the spectra from the grating tilted to the right are much more intense than those obtained when the grating is tilted to the left, while the reverse is the case in the third order, and furthermore the lines are sharper when the grating is tilted to the left. Consequently the rotation plates obtained were made with the grating tilted to the left and the left two-fifths of the grating masked together with the central strip placed over the face of the lens to cut off the reflected light. The focal curves, for left and right inclinations of the grating were obtained in the first three and part of the fourth orders, for the whole grating with the central strip masked. These are plotted in Fig. 29, the dotted lines being the photographically determined curves and the continuous lines, those visually determined. It will be seen that the locus of the foci for any wave-length in the different orders, instead of being a straight line of constant focus, is a curve (nearly a straight line) of varying focus. This is very likely due to the character of the reflecting surfaces between the scratches on the grating, for it may be assumed that the diamond scratching-point distorted the strips between the scratches in such a way as to make one side of the surface slightly convex and the other slightly concave, as might easily happen since on one side of the diamond-point the speculum is scratched or furrowed, while on the other side it is not. At any rate the grating is not what it should be for the work planned for this spectrograph. This work must necessarily deal with the exact positions and character of the spectral lines and any large or small changes in these. It is chiefly the minute changes that are of interest at present in solar investigations, and the very best possible definition of the spectrum lines is required for a satisfactory measurement of these changes. It is hoped that a new grating of first quality may soon be secured, as such is necessary to yield satisfactory results. Everything else is now in readiness for the careful study of solar problems.

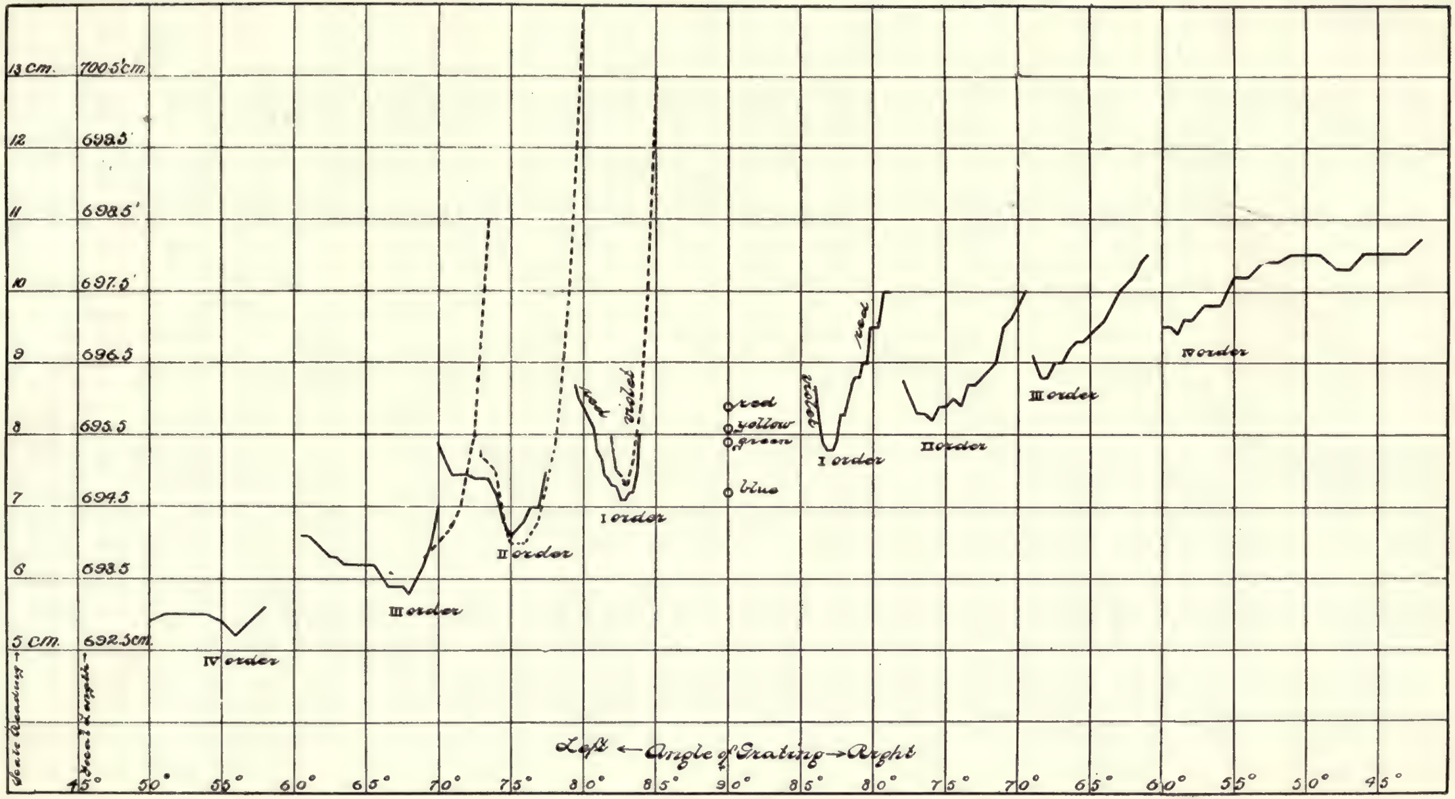


FIG. 29—Focal Curves of Solar Spectrograph.

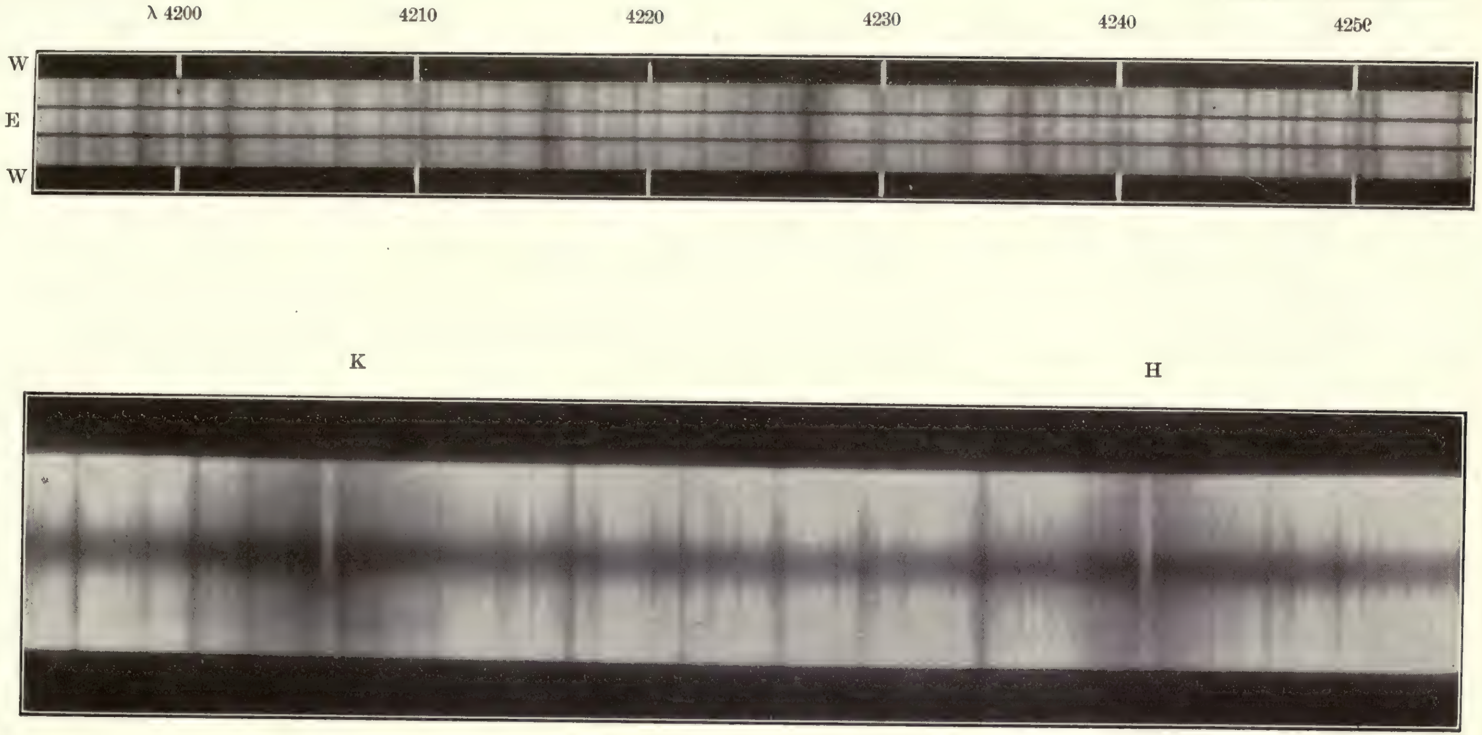


FIG. 30—Part of Rotation Plate L 413. Scale of the original, 1 A.U. = 1.115 mm.
Part of sun-spot Plate, L 405, showing emission in K and H. Scale of the original 1 A.U. = 1.11 mm.

In addition to rotation-plates, plates of the sun spot spectra were obtained whenever the conditions were suitable. Samples of both are shown in Fig. 30. In the following table the measurements of a sample rotation-plate (L 413) are given. In taking these plates long exposures (10 or 12 minutes in the third order near 4300) were necessary owing to the fact that a very small area of the grating was used. During this interval the sun's image would become blurred and distorted, thus allowing light from different points on the sun's surface to pass through the slits. The poor values in the following table are probably partially due to this cause and partially also to aberrations produced by some of the curious properties of the grating and to the very poorly defined lines produced. Many of the lines were so poor that measurements of them were not made and many of the finer lines were spread out and weakened so as to be almost invisible. It is hoped that the new grating will remedy these defects.

Measurements of plate L 413, 0°·0, slits 226mm. apart, diameter of the sun 232 mm.:—

λ	Mean of 5 mm. readings middle strip	Mean of 5 mm. readings lower strip.	Mean of 5 mm. readings upper strip.	Mean difference.	2δλ	Velocity km. per sec.
4136·678	2·9828	3·0314	3·0430	0·0544	0·0488	1·77
4137·156	3·5233	3·5650	3·5931	557	499	1·81
4140·089	6·7876	6·8342	6·8411	500	448	1·62
4147·836	15·4109	15·4623	15·4711	558	500	1·81
4149·533	17·2990	17·3517	17·3520	529	474	1·71
4150·411	18·2771	18·3256	18·3411	513	460	1·66
4154·071	22·5768	22·6215	22·6324	502	450	1·62
4154·667	23·0205	23·0724	23·0828	571	512	1·85
4154·976	23·3789	23·4309	23·4333	532	477	1·72
4157·948	26·6898	26·7408	26·7492	452	405	1·46
4157·948	26·6868	26·7431	26·7558	627	562	2·03
4158·959	27·8144	27·8550	27·8718	490	439	1·58
4163·818	33·2268	33·2824	33·2919	604	542	1·95
4169·110	39·1097	39·1550	39·1763	560	502	1·81
4171·068	41·2803	41·3317	41·3462	587	526	1·89
4174·095	44·6767	44·7188	44·7331	489	438	1·57
4175·806	46·6005	46·6480	46·6549	510	457	1·64
4176·739	47·6361	47·6780	47·6990	524	470	1·69
4179·025	50·1899	50·2346	50·2450	499	447	1·60
4179·025	50 1928	50·2358	50·2405	454	407	1·47
4181·919	53·4269	53·4799	53·4878	571	512	1·84
4182·548	54·1376	54·1827	54·1958	517	463	1·66
4187·204	59·3360	59·3872	59·3987	570	511	1·83
4187·943	60·1723	60·2212	60·2388	577	517	1·85
4187·943	60·1754	60·2208	60·2423	562	504	1·81
4196·372	69·5688	69·6076	69·6247	474	425	1·52
4199·267	72·7938	72 8540	72·8663	664	596	2·13
4199·267	72·8065	72·8626	72·8720	608	545	1·95
4201·089	74·8526	74·9020	74·9137	553	496	1·77
4202·919	76·8960	76·9398	76·9492	485	434	1·55
4203·730	77·8073	77·8667	77·8677	599	537	1·92
4204·622	78·7510	78·8003	78·8116	550	493	1·76
4207·291	81·7826	81·8279	81·8413	520	466	1·66
4208·766	83·4393	83·4904	83·4972	545	488	1·74
4213·812	89·0824	89·1385	89 1469	601	539	1·92
4216·351	91·9078	91·9656	91·9685	593	532	1·89
4220·509	96·5671	96·6150	96·6305	557	499	1·77
4233·328	110·4159	110·4651	110·4745	539	483	1·71
4236·112	113·1064	113·1574	113·1659	553	496	1·76
4236·279	113·2910	113·3460	113·3567	604	542	1·92
4236·279	113·2911	113·3482	113·3563	612	549	1·94
4238·970	116·3636	116·4092	116·4177	499	447	1·58
4246·966	126·2158	126·2723	126·2819	613	550	1·94
4258·774	139·0965	139·1464	139·1514	524	470	1·66
4265·418	147·6064	147·6630	147·6666	584	524	1·84
4268·915	150·7909	150·8440	150·8464	543	487	1·71
4271·325	153·4834	153·5426	153·5454	606	544	1 91
4271·934	154·6638	154·7190	154·7275	595	533	1·87

Measurements of Plate L 413 (Continued).

λ	Mean of 5 mm. readings middle strip	Mean of 5 mm. readings lower strip	Mean of 5 mm. readings upper strip.	Mean difference.	2δλ	Velocity km. per sec.
4274·958	157·5662	157·6159	157 6230	0·0533	0·0478	1·68
4279·643	162·8316	162·8856	162·8923	574	515	1·81
4282·565	166·1090	166·1575	166·1650	523	469	1·64
4283·169	166·7867	166·8456	166·8437	580	520	1·82
4287·566	171·7201	171·7671	171·7684	477	427	1·49
4288·310	172·5555	172·6182	172·6188	630	565	1·98
4289·525	173·9153	173·9697	173·9714	553	496	1·73
4289·885	174·3185	174·3698	174·3829	579	519	1·82
4290·080	174·8803	174·9256	174·9400	525	475	1·66
4390·377	175·0671	175·1189	175·1266	557	499	1·74
4291·114	176·2785	176·3263	176·3375	534	479	1·67
4295·383	181·0754	181·1309	181·1437	619	555	1·94
4300·211	185·9150	185·9642	185·9754	548	491	1·71
4300·211	184·7011	184·7533	184·7603	557	499	1·74
4302·692	187·4850	187·5400	187·5453	577	517	1·80
4312·462	200·4632	200·5002	200·5203	571	512	1·78
4316·962	205·6104	205·6557	205·6737	543	487	1·69
4320·907	207·9588	207·9978	207·0193	498	446	1·55
4321·119	208·1885	208·2350	208·2553	567	508	1·76
4331·811	220·2219	220·2719	220·2817	549	492	1·71
4337·216	226 3078	226 3617	226·3729	595	533	1·85
4338·084	227 2934	227·3348	227·3580	530	475	1·64
4338·430	227·6796	227·7315	227·7403	563	505	1·75
4339·617	229·0152	229·0619	229·0751	533	478	1·65
4339·882	229·3068	229·3559	229·3787	605	542	1·87
4343·861	233·7958	233·8477	233·8647	604	542	1·87
4344·451	234·4621	234·5066	234·5309	567	508	1·74
4344·670	234·7022	234·7509	234·7669	567	508	1·75
4344·670	234·7023	234·7510	234·7679	572	513	1·77
4351·216	242·0735	242·1259	242·1400	595	533	1·84
4351·216	242·0719	242·1223	242·1343	564	506	1·74
					Mean....	1·77

The scale, which is practically constant over the whole plate, is 1 A. U. = 1·11 mm., hence $2\delta\lambda = \frac{\text{mean difference}}{1{\cdot}115}$. The velocity is $\frac{\delta\lambda}{\lambda}$ (Velocity of light) 299860 $\frac{\delta\lambda}{\lambda}$ km. per second. Heliographic latitude of the centre of the sun's disc wa 6° 26′ when plate L 413 was taken, consequently the velocity at the equator, as deter mined by this plate is $\frac{232}{226} \cdot 1{\cdot}77 \cdot \frac{1}{\cos 6^\circ\ 26'} = 1{\cdot}83$ km. per second. This value is th linear velocity of the sun's limit at the equator, as measured, and will evidently giv the synodic period of the rotation, the value for which is 1·86, as given by Adams. T reduce to the sidereal period requires the addition of 0·14km., making the velocit 1·97km. The generally accepted value is approximately 2·05km. per second, and th deficiency in the present case may be safely ascribed to errors introduced by the grating

APPENDIX D.

OUBLE STAR MEASURES. PHOTOGRAPHS OF COMET MOREHOUSE. OCCULTATIONS OF STARS BY THE MOON. FIELD INSTRUMENTS. ABERRATIONS OF THE STELLAR CAMERA OBJECTIVE.

R. M. Motherwell.

DOUBLE STAR MEASURES.

Three half nights each week have been devoted to micrometer and photographic ork, including the series of tests made on the camera objective. Micrometer work s consisted principally of the determination of the position angles and distances of sual double stars, the working list being prepared from Burnham's Catalogue of uble Stars. An endeavour is being made to measure only those which have not been easured for some time or whose motion is such as to require frequent measurements.

The filar micrometer used, is the Warner and Swasey type, and it has been found ther unsatisfactory in the determination of position angles owing to there being no ick-motion screw for moving the position circle. A self-registering attachment ould be a great improvement as the present arrangement requires the frequent use of hand-lamp which dazzles the eye. Considerable difficulty has also been experienced keeping the eye-piece clear of frost in the winter, each setting of the micrometer-ad or position-circle requiring several clearings of the glass.

Following are the measures made during the past year, each measure being the ean of eight settings for position angle and four double-distance measures:—

Star No.	Date.	Position Angle.	Distance.	Star No.	Date.	Position Angle.	Distance.
		°	″			°	″
151..........	1908·786	279·0	1·34	7117..........	1908·464	298·2	Cloudy.
269..........	1908·765	113·9	5·78	7318..........	1908·317	184·3	3·81
1427..........	1908·921	313·9	3·28	....	1908·575	186·8	4·01
1750..........	1908·921	249·1	17·24	7429·5..........	1909·429	252·9	9·39
2040..........	1908·921	218·8	4·21	7450..........	1908·575	15·2	8·70
2043..........	1908·921	328·5	....	....	1908·617	14·3	9·21
2536..........	1908·996	305·3	2·73	....	1908·631	14·0	9·53
3398..........	1908·996	6·4	....	....	1909·412	14·9	8·91
4452..........	1909·341	43·3	2·60	....	1909·429	13·9	9·32
4530..........	1909·086	139·6	6·12	7451..........	1908·317	255·4	16·64
4890..........	1908·247	196·9	5·14	....	1908·464	254·1	17·11
....	1909·086	196·7	4·88	....	1908·575	254·8	16·57
....	1909·303	197·0	5·11	....	1908·617	256·0	16·17
5011..........	1908·247	45·5	1·88	....	1908·631	254·6	16·65
5014..........	1909·202	235·9	3·50	7458..........	1908·575	288·9	3·24
....	1909·303	234·0	3·39	7604..........	1908·464	211·9	17·12
....	1909·341	235·5	3·40	....	1908·497	211·9	16·89
5125..........	1908·304	146·5	3·43	....	1908·575	214·0	16·59
5319..........	1908·304	176·9	2·50	7642..........	1908·575	89·8	1·77
....	1908·426	177·3	2·78	7915..........	1908·439	18·2	5·03
5337..........	1908·977	295·2	30·78	....	1908·492	20·0	5·38
....	1909·183	294·4	31·50	....	1908·617	18·4	5·48
....	1909·202	294·8	31·89	5388..........	1908·247	117·4	3·88
....	1909·399	294·3	31·09	....	1908·426	115·5	3·43
6780..........	1909·183	353·4	Too frosty	....	1909·183	114·1	3·89
7065..........	1909·183	111·1	"	....	1909·399	116·4	3·82

Star No.	Date.	Position Angle.	Distance.	Star No.	Date.	Position Angle.	Distan
		°	"			°	"
5426..........	1908·247	68·6	3·05	....	1908·641	338·7	27·4
....	1909·303	68·1	3·50	....	1908·765	339·3	26 9
....	1909·399	66·5	3·27	9034..........	1908·541	51·9	7·8
5705..........	1909·303	32·2	3·37	....	1908·581	50·5	8·5
5809..........	1908·977	27·6	24·86	9037..........	1908·541	7·41	5·9
....	1909·078	28·0	25·17	....	1908·581	7·33	5·8
....	1909·086	30·7	24·90	....	1908·641	7·24	5·6
....	1909·202	27·6	24·89	....	1908·765	7·12	5·9
....	1909·303	28·3	25·33	9167..........	1908·541	154·8	0·8
6030..........	1908·426	308·5	2·80	....	1908·613	154·5	0·8
6033..........	1908·426	108·8	6·28	9604..........	1908·541	9·7	2·8
....	1909·078	107·8	5·72	....	1908·613	10·5	2·7
....	1909·202	106·8	6·06	9693..........	1908·492	138·6	4·0
....	1909·303	106·7	6·57	....	1908·522	138·0	3·7
6035..........	1909·078	178·9	16·32	....	1908·575	138·3	....
....	1909·086	181·7	16·10	....	1908·581	138·6	4·0
....	1909·183	179·3	16·50	....	1908 613	137·8	3·9
....	1909·399	179·4	16·41	9905..........	1908·600	271·1	....
6211..........	1908·426	359·2	2·60	9969..........	1908·600	155·7	Cloud
6386..........	1909·360	119·0	2·99	9977..........	1908·641	170·1	4·3
7927..........	1908·617	127·0	33·08	....	1908·765	171·0	4 3
....	1908·631	125·3	33·24	....	1908·786	171·8	3·5
....	1909·429	126·5	33·21	10061..........	1908·765	185·3	7·1
7930..........	1908·617	180·8	24·94	10072..........	1908·613	212·2	Hazy
....	1908·631	180·5	24·93	10305..........	1908·522	74·2	"
8003..........	1908·309	312·4	4·15	10385..........	1908·581	111·0	3·5
....	1908·445	313·3	4·17	10685..........	1908·522	164·6	1·8
8082..........	1908·309	22·8	8·11	10709..........	1908·613	158·3	3·3
....	1908·426	22·6	7·98	10742..........	1908·613	349·2	22·9
....	1908·439	25·4	7·91	....	1908·765	351·5	23·8
....	1908·445	24·4	7·95	10773..........	1908·522	309·3	3·3
8303..........	1908·309	258·5	2·67	....	1908·541	307·9	....
....	1908·445	258·7	....	....	1908·581	307·5	3·7
....	1908·617	259·7	2·53	....	1908 786	307·8	3·4
8364..........	1908·617	81·6	2·71	....	1908·805	308·8	3·1
....	1908·746	78·2	2·87	10901..........	1908·613	112·6	5·6
....	1908·765	79·4	2·70	....	1908·641	112·0	5·6
....	1909·429	78·2	3·00	12043..........	1908·765	34·3	5·9
8384..........	1908·624	79·0	1·49	12753..........	1908·765	160·1	3·0
8404..........	1908·631	338·4	27·15				

COMET 1908C (MOREHOUSE).

This comet was visible for over three months, but dense smoke and unusua cloudy weather prevented any attempt at obtaining an extensive series of photograp Single exposures were made on seven different nights, with the Brashear Doub attached to the equatorial telescope. A filar micrometer was used in guiding and w very satisfactory in preventing drifting but, owing to the smallness of its field, d not permit of the head of the comet being shifted appreciably from the centre of t camera field. Had it been possible to so shift the head, more of the tail would ha been included in the photograph.

The following table gives the date and duration of each exposure:—

Plate.	Eastern Standard Time.	Beginning of Exposure.	Duration.	Remarks.
	1908.	h m	h m	
31..........	October 16..........	6 45	1 0	Very smoky.
32..........	" 19..........	6 10	1 5	"
33..........	" 31..........	7 25	0 55	Clear.
34..........	November 1..........	7 15	0 55	Clear but unstead
35..........	" 13..........	6 15	1 0	Very clear.
36..........	" 26..........	5 30	1 25	Clear, high wind.

FIG. 31 & 32—Morehouse's Comet.

FIG. 33 & 34—Morehouse's Comet.

Fig. 35 & 36—Morehouse's Comet.

An exposure of one hour was made on October 20, but the smoke was too dense. In the course of the exposure the head of the comet passed over an eighth magnitude star without perceptibly dimming it.

Fig. 31. The dense smoke accounts for the faintness of this photograph, but still it is the most interesting one of the set, on account of the knots in the tail about one and a half degrees from the head. This portion seems to have separated from the head and drifted off while new matter has been given out. There has also probably been a motion southward on the part of this detached mass, greater than that of the comet as the new matter in the tail connects with the north side of the knots, while the southern part is altogether clear of the tail. The curved form of the central and southern portions of the detached mass is also worthy of notice. The new matter is connected to the head by a narrow neck and on either side rays extend back about 0·5 degrees.

Fig. 32. This photograph is even more faint than Fig. 31, but the head shows considerable detail. The new portion of the tail spoken of in Fig. 31 has apparently been forced back by the rays on either side, they being joined together now just back of the head. Although only three days have elapsed between these exposures we can readily see that, during this interval, the comet has been very active internally.

Figs. 33 and 34 indicate a continuation of this activity. Fig. 33 shows several distinct knots in the tail about one to one and a half degrees from the head. Beyond these the tail gradually widens out, being uniform on the north side but broken on the south side. Fig. 34, one day later, shows the same knots farther away from the head and more diffused. They seem to have been separated from the nucleus, the bright portion next to the head in Fig. 33 broadening out here into a fan-shaped tail. Beyond the knots the tail has widened slightly.

Fig. 35 shows a very bright tail extending out about two degrees with short rays on both sides of the head. As in Fig. 33 the north side of the tail is uniform, while the south side shows several offshoots. The comet was apparently in a very active state at this time, but thirteen days elapsed before I had an opportunity for another exposure, and Fig. 36 shows a much fainter and divided tail. Evidently the activity has become much less, the faintness of the tail being partly due to its division into two parts, but more particularly to a change in the conditions governing the state of the comet's head. Are these changes in appearance due to some internal state or are they due to changes in the surrounding medium?

While this set of photographs can lay no claim to completeness, it demonstrates clearly the necessity for frequent exposures at as close intervals as possible if we wish to know with any degree of accuracy the changes actually taking place. It also shows that these exposures should not be too long, otherwise one plate might be a combination of several phases.

No other comets were visible here in 1908, but several exposures were made toward the close of the year in search of Halley's comet. The end of July or the early part of August, 1909, should see the discovery of this famous celestial visitor. Photography will doubtless first reveal its presence and on account of this it is desirable that the stellar camera should be available for work every night. With the present mounting of the camera this means the suspending of all work with the equatorial at such times when the comet may be observed. This is much to be regretted as both the equatorial telescope and the camera are excellent instruments, and it is hoped that a separate mounting may be provided for the camera at an early date. Halley's comet will not return for at least seventy-five years, but every year brings with it new comets; so if our Dominion Observatory is to take a foremost place in the discovery and study of these strange visitors, the equipment necessary for camera work should be provided at once.

OCCULTATIONS OF STARS BY THE MOON.

The observations of occultations have been made mostly with the 15-inch equatorial telescope as its superior mounting and clock-work render it much more satisfac-

tory than the 4½-inch Cooke telescope. Predictions have been made by the graphical method of Wm. F. Rigge, but less than 10 per cent of the predicted occultations were observed owing to cloudy weather. Following are the observations:—

OCCULTATIONS OF STARS BY THE MOON.

Date.	Phenomenon.	Star.	Limb.	G.M. Time of observation.		
1908.				h.	m.	s.
April 9	Disappearance	η Cancri	Dark	6	53	53·2
" 13	"	ν Virginis	"	7	2	55·6
	Reappearance	"	Bright	8	8	36·5
June 11	Disappearance	o^1 Libræ	Dark	13	44	23·3
" 12	"	ν^2 Scorpii	"	11	28	11·1
	Reappearance	"	Bright	12	0	16·8
October 13	Disappearance	n Tauri	"	16	52	41·0
November 1	"	γ Capricorni	Dark	5	30	1·8
1909.						
January 7	"	γ Cancri	Bright	12	19	15·8
March 12	"	β^1 Scorpii	"	16	35	6·1
	Reappearance	"	Dark	17	25	37·8
	Disappearance	56B Scorpii	Bright	16	35	59·7
	Reappearance	"	Dark	17	24	50·0
March 14	Disappearance	63 Ophiuchi	Bright	16	12	3·1
	Reappearance	"	Dark	17	30	57·4

INSTRUMENTS USED ON THE BOUNDARY AND GEODETIC SURVEYS.

The instruments used on these surveys have all been carefully catalogued and stamped, an index system being used which shows the office number, description of instrument, price, date of receival, name of maker, location and disposal of each instrument. A separate account is also kept of the instruments as taken out by each party in the spring, so that each man can readily see what instruments he is held responsible for.

Following is a list of the principal instruments used during the season of 1908:—

Name of Instrument.	Number Used.	Name of Instrument.	Number Used.
Barometers	20	Heliotropes	8
Balances	5	Levels	11
Binoculars	18	Plane Tables	5
Cameras	18	Sextants	2
Chronometers	14	Tapes	25
Clinometers	4	Telescopes	9
Compasses	25	Transits	47

ABERRATION OF THE STELLAR CAMERA OBJECTIVE.

The stellar camera used in the Dominion Observatory, Ottawa, for photographing star clusters, nebulæ, comets, or any other celestial objects covering a wide field, is fitted with a Brashear photographic doublet of 203mm. aperture and 1060·3mm. focus. The camera tube (Fig. 37) is bolted to the telescope tube opposite to its place of attachment to the declination axis. This method of mounting is rather unsatisfactory, however, as the telescope tube intercepts a large portion of the light on the west side of the plate.

The effective field has a diameter of about 11° 20′, so the camera is well adapted in this respect to its work. The tube containing the objective is nickelled and moves freely in the main metal tube, the position of focus being adjusted by a rack and pinion with a clamp screw to hold it in the required position. This position is read on

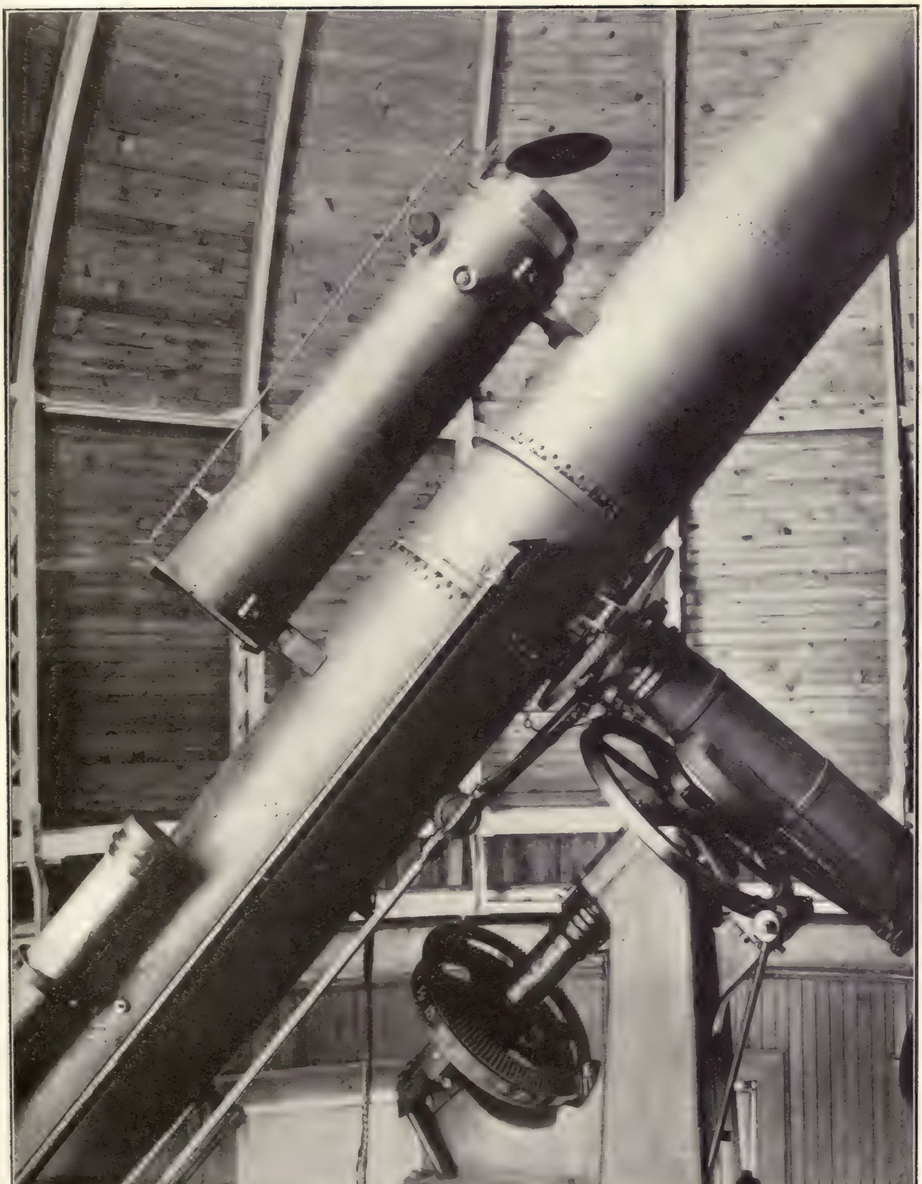


FIG. 37—Stellar Camera.

a millimetre scale. A metal shutter covers the objective and the plates are held in a metal frame fitted with springs. When accurate guiding is required the micrometer wires in the telescope are used, the great focal length of the refractor, as compared with the camera, rendering the guiding a simple matter.

The following description of the lens is given by Dr. Brashear:—

'The general construction is that which was first found by Petzval years ago, and has proven itself quite the best, where great angular aperture with sharp definition is required. The curves have been somewhat modified from our experience in the construction of other lenses—particularly those made for Dr. Max Wolf, of Heidelberg, Germany. It departs, however, from the ordinary practice of opticians in being corrected for short wave-lengths of light. This would be quite objectless in a camera which is to be used for portraits, but is not without moment in astronomical photography. The materials employed were specially chosen for their transparency, the flint being very light and the crown very white. The focal lengths of the front and rear combinations are in a ratio of about 7 to 12, while the focal length of the system is very nearly five times the aperture. The focal length we may find very slightly modified: indeed it is our custom to balance the inevitable zonal differences of magnification, which difficulty is found the most formidable to all constructors of astronomical photographic objectives.'

The camera gives a more uniformly defined field than most cameras of this type, but the definition is not sufficiently sharp to produce clear cut images. When a long exposure is made to reach faint stars there are three resulting forms of image. The fainter stars give a clear cut image, the next in brightness give an image with a dark centre surrounded by a halo, while the brighter stars give an image of uniform density but much enlarged. This variation in the images must be due to aberration, either spherical or chromatic, producing, instead of point images, discs of sensible size, possibly with a centre somewhat more intense than the surrounding portion. The difference in the appearance of the images of stars of different brightness on the negative is thus readily explained by the light of the fainter stars not being sufficient to form a halo, as in the next brighter stars, while in the very bright stars the light is strong enough to make the halo as dense as the central portion. The only question is whether this aberration is spherical or chromatic.

The most simple test for the presence of zonal errors in a lens is that of Hartmann, the theory involved being very simple, and the equipment for the experiment

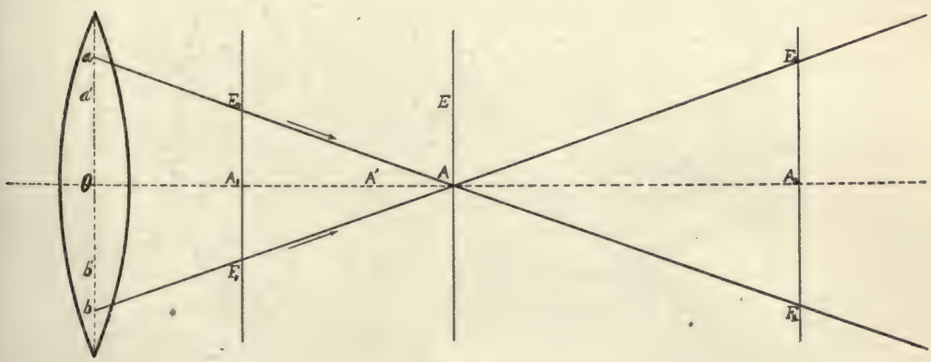


FIG. 38.

being within reach of any one. This method involves the determination of the point of intersection of rays of light passing through the lens at opposite ends of a diameter and equidistant from the centre.

Let L (Fig. 38) be the lens under test and consider two rays passing through a, b; so that $0a = 0b$. These rays converge to a point A which is called the focus of these rays. If these rays are intercepted at A we find them in a single point, but if intercepted at E_1 or E_2 we find them separated by a distance d_1 or d_2. These distances may be measured with a micrometer, or photographic plates may be placed at E_1, E_2, and the distances between the resulting images measured. This latter method has beeu employed in the present test.

Measuring the distances $0A_1$, $0A_2$ and d_1, d_2, we can easily obtain the correct position of focus.

$$\begin{aligned} \text{Let } 0A_1 &= A_1 \qquad E_1\,F_1 = d_1 \\ 0A_2 &= A_2 \qquad E_2\,F_2 = d_2 \\ 0A &= A \end{aligned}$$

Then $A = A_1 + \dfrac{d_1}{d_1 + d_2}(A_2 - A_1)$. This is a simple geometrical property requiring no proof.

Again, consider two rays passing through at a', b'. If the lens is correctly ground these two rays will converge to the point A as did a and b, and so with rays from all parts of the lens. But unfortunately this is a difficult condition to obtain, the best of lenses being but a close approximation to it. In place of converging to A, a' and b' converge to some other point, say A', giving what is called zonal aberration, so that if we focus our camera for a and b, it is out of focus for a',b', and we get a disc about our image.

Take two rays at a distance $0a$ from the centre but on a diameter perpendicular to a, b, and consider their focus. If the lens is symmetrical for this zone, then the four rays will meet at the point A, their common focus, but if not symmetrical there will be two different foci for the two pairs of rays. This difference is called axial astigmatism and can be revealed in the Hartmann test for aberration.

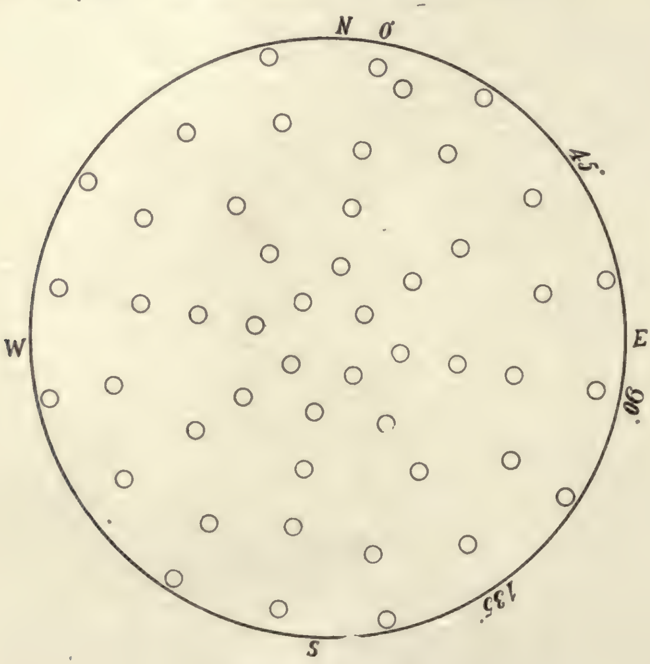


FIG. 39—Zonal Disc.

The lens is covered with a zone plate of the form shown in Fig. 39. The apertures are placed in ten zones of 15, 25, 35, 45, 55, 65, 75, 85, 94 and 98 mm. radius respectively. Each pair of openings is duplicated by a second pair at right angles in order to determine the axial astigmatism. In the case of the zones of 15, 25, 35, 45, 55, 65, 85 and 94 mm. radius, symmetrical pairs of apertures are placed 90° apart, but in the zones of 75 and 98 mm. radius the apertures are only 45° apart, so the outer part of the lens is more thoroughly tested than the centre. This is necessary owing to the greater amount of light admitted by the outer zones.

By making an exposure at E_1 and another at E_2, we can determine two positions of focus for each of the ten zones, these two positions being perpendicular to each other. An extra aperture in the zone plate enables one to identify the angle for the several zones and so avoid confusion in the determination of astigmatism.

The first zone plate used had apertures of 10 mm., but the diffraction at the edges was so great that in place of solid dark spots there were circular dark rings which did not permit of accurate measurement. The second zone plate used had a diameter of 203 mm. with apertures of 5·5 mm. These plates were made of medium weight bristol board. Exposures of 6 minutes were made on Capella. In order to avoid as much as possible chromatic aberration, Seed Process plates were used, their band of sensitiveness being narrow and confined chiefly to the blue and violet light beyond λ 4600. A plate with a wider range of sensitiveness would give images so elongated radially by chromatic aberration as to render accurate measurements very difficult or impossible.

All measures were made on the Zeiss comparator, the graduations reading to thousandths of a millimetre and readily estimated to ten thousandths. Test plates were first made with 4 x 5 Seed plates, to determine the correct time of exposure, a plate-adapter being used in the regular plate-holder. The positions corresponding to E_1 and E_2 were at 22 mm. and 67 mm., respectively, on the focussing scale on the camera tube. This gave the distance $A_2 - A_1$ equal to 45 mm. In the appended results the focus given is that which would be used in setting according to the above mentioned scale. The actual focus of the camera was determined as follows:—The telescope was set midway between Castor and Pollux and a photograph taken, with the camera at its usual focus (47·5 mm. on the scale) and the zone plate removed. The distance between the images on the photographic plate was measured and found to be $d = 79{\cdot}5260$ mm.

From the Ephemeris we have—

	R. A.	Dec.
Castor,	$7^h\ 28^m\ 43^s{\cdot}9$	$+ 32°\ 5'\ 28''{\cdot}13$
Pollux,	$7^h\ 39^m\ 41^s{\cdot}284$	$+ 28°\ 14'\ 56''{\cdot}34$

The difference in R. A. is $0^h\ 10^m\ 57^s{\cdot}384 = 2°\ 44'\ 20''{\cdot}76$

Zenith distance of Castor is $57°\ 54'\ 31''{\cdot}87$

Zenith distance of Pollux is $61°\ 45'\ 3''{\cdot}6$

From $\cos a = \cos b \cos c + \sin b \sin c \cos A$, we have $a = 4°\ 30'\ 48''$
= the distance between Castor and Pollux.

Hence, from the cotangent of a and the value of d we have the focus required

$$f = 1060{\cdot}3 \text{ millimetres.}$$

When the correct time of exposure had been obtained, the regular 8 x 10 plates were used and a series of exposures made at E_1 and E_2. Although the original object in view was to test for spherical aberration at the centre, this was extended to cover the whole field of the lens and images were made extending across the plate from south to north, in order to determine the curvature of field. Nine images were obtained within the focus and nine without, their respective positions being:—

Position	A, 5°·3	from	centre	towards	south	end.
"	B, 4°	"	"	"	"	
"	C, 2°·5	"	"	"	"	
"	D, 1°	"	"	"	"	
"	E, at centre.					
"	F, 1°	from	centre	towards	north	end.
"	G, 2°·5	"	"	"	"	
"	H, 4°	"	"	"	"	
"	I, 5°·5	"	"	"	"	

Owing to the uncertainty of the weather, exposures at positions A, B, C, D and E were made on one plate without the focus, and then exposures were made on another plate at the same positions within the focus. Exposures at F, G, H and I were then made on two other plates. This unfortunately caused a slight change in the adjustment of the camera and the result was an unaccountable dip in the curvature of the field. Further test plates were made at positions E, F and H, which showed clearly that the dip was not due to any fault of the lens, the resulting curve being quite uniform, as shown in Figs. 43 and 44.

The several plates were first measured for aberration and astigmatism. A summary of the results is given in the appended tables and curves. As stated before, the positions E_1 and E_2 correspond to 22 mm. and 67 mm. on the scale attached to the camera. The camera was set at 47·5 mm. to determine the focus $f = 1060.3$ mm. So we have $A = 1034{\cdot}8$ mm. and $A_2 - A_1 = 45$ mm. To obtain the actual focus for each zone in the following results we must add 1034.8 mm. to each given focus.

Position	A	shows	a negative	aberration of	3·61 mm.
"	B	"	"	"	3·82 mm.
"	C	"	"	"	3·75 mm.
"	D	"	"	"	3·63 mm.
"	E	"	"	"	3·60 mm.
"	F	"	"	"	3·63 mm.
"	G	"	"	"	3·64 mm.
"	H	"	"	"	3·82 mm.
"	I	"	"	"	3·63 mm.

Such a marked aberration, extending so uniformly across the field, shows beyond any doubt the cause of the diffuse appearance of the images already referred to. The curves in Figs. 40 and 41, each division representing 1 millimetre, show very clearly the magnitude of the aberration and its uniformity across the field from south to north. Another plate R, made on the east side of the field, shows a similar aberration, curve *P*, Fig. 42, representing it graphically.

Taking the mean focus for each zone we find the astigmatism so small as to be neglected at the centre of the field but increasing as we move outward. A closer examination reveals the fact that where $\varphi = 0°$, 90°, 67°·5 and 157°·5, the astigmatism is the greatest. This is due to the varying angle of incidence of the rays on the plate in the several positions A, B, C, etc. This variation in angle affects the distance between the images in the respective zones inversely as the angles they make with the north and south line. Thus (see Fig. 39) when $\varphi = 0°$, the change in distance is greatest; when $\varphi = 90°$, the change in distance is least; when $\varphi = 45°$, the change is almost the same as when $\varphi = 135°$. So we see that the apparent variation in astigmatism is due to the position of the plate and consequent distortion of some of the images rather than to any defect in the lens.

As already stated, the Seed Process plate used has its maximum sensitiveness about λ 4300 in the blue light. Thinking perhaps the lens had originally been tested with yellow light, owing to the difficulty of obtaining monochromatic light in the blue, it was consequently decided to test the lens by visual or yellow light. Cramer Iso-

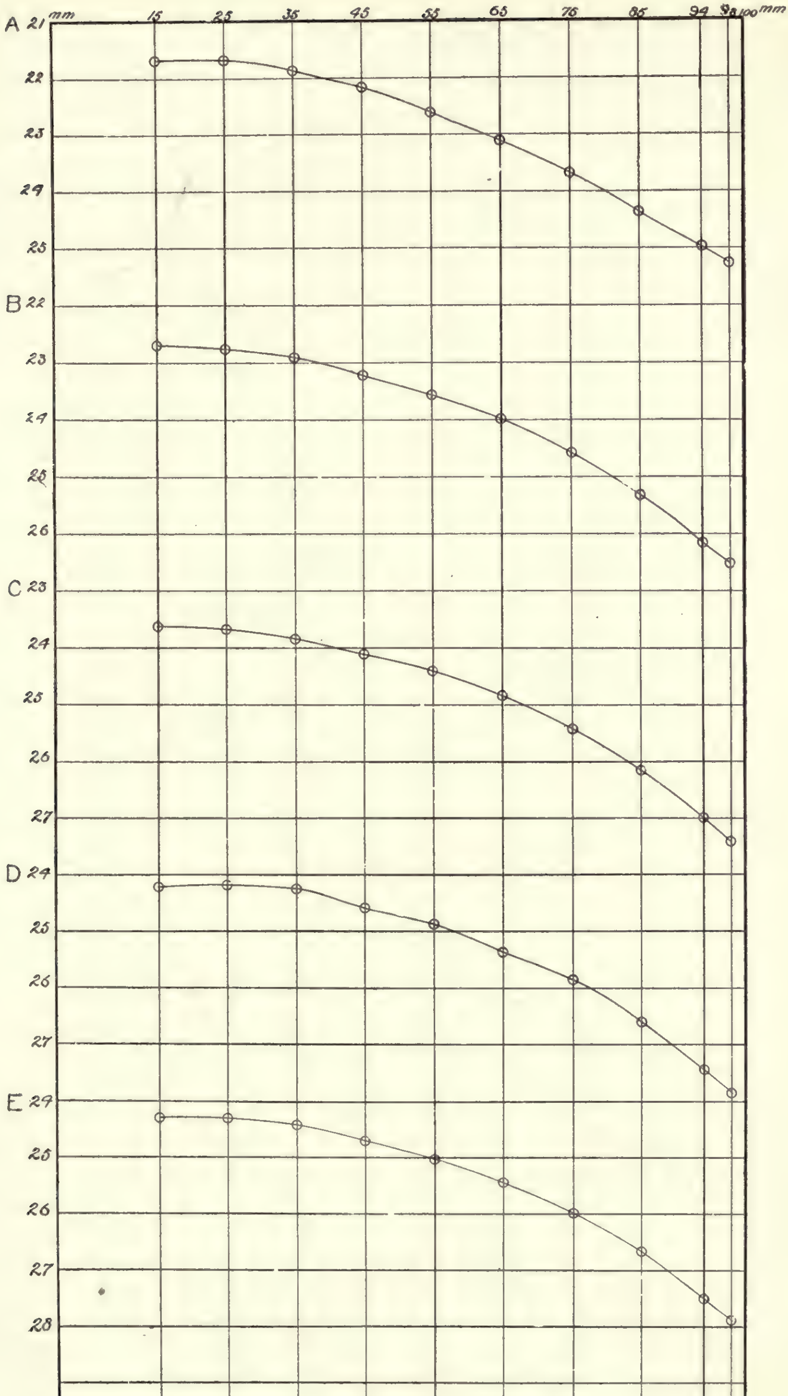


FIG. 40—Zonal Differences of Focus.

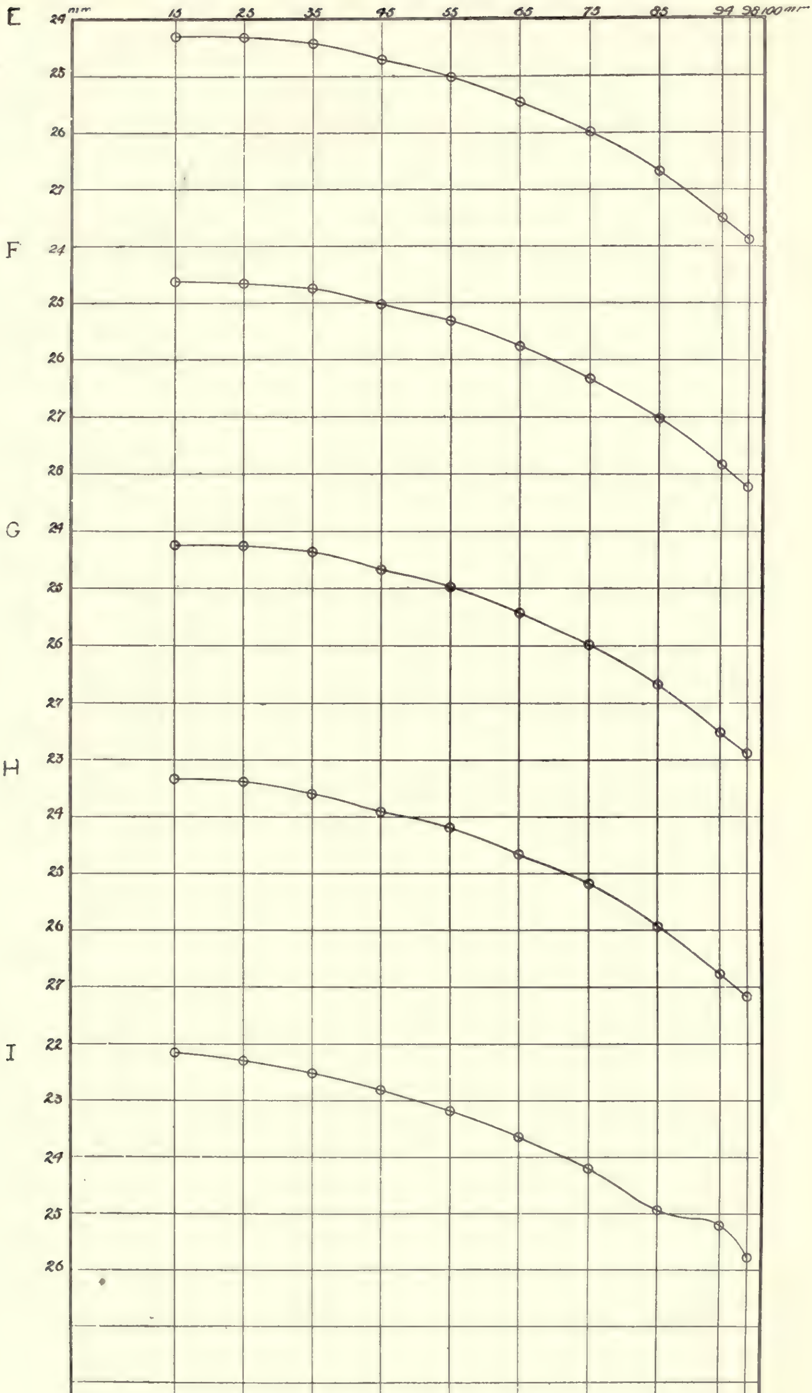


Fig. 41—Zonal Differences of Focus.

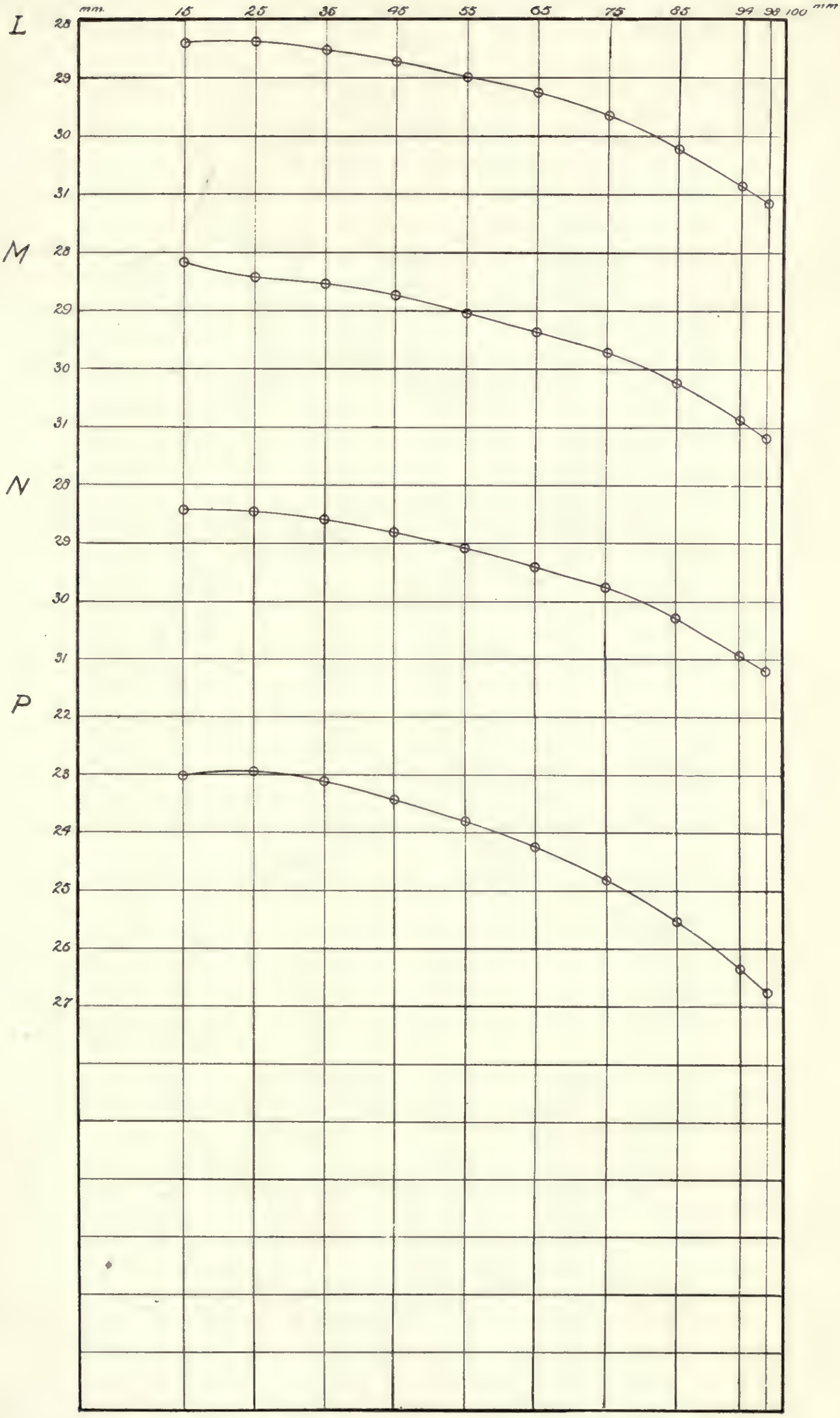


FIG. 42—Zonal Differences of Focus.

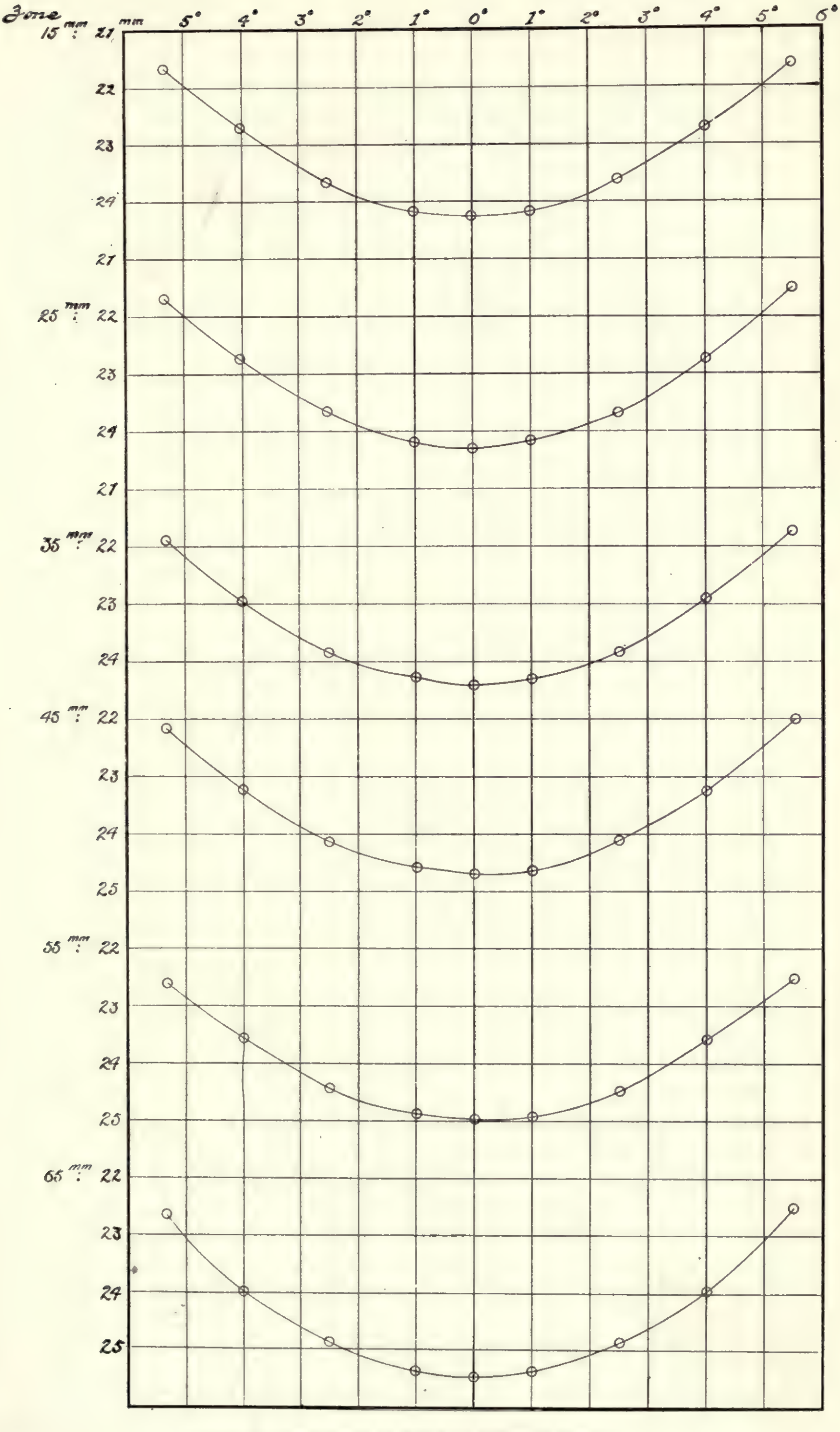


FIG. 43—Curvature of Field at different Zones.

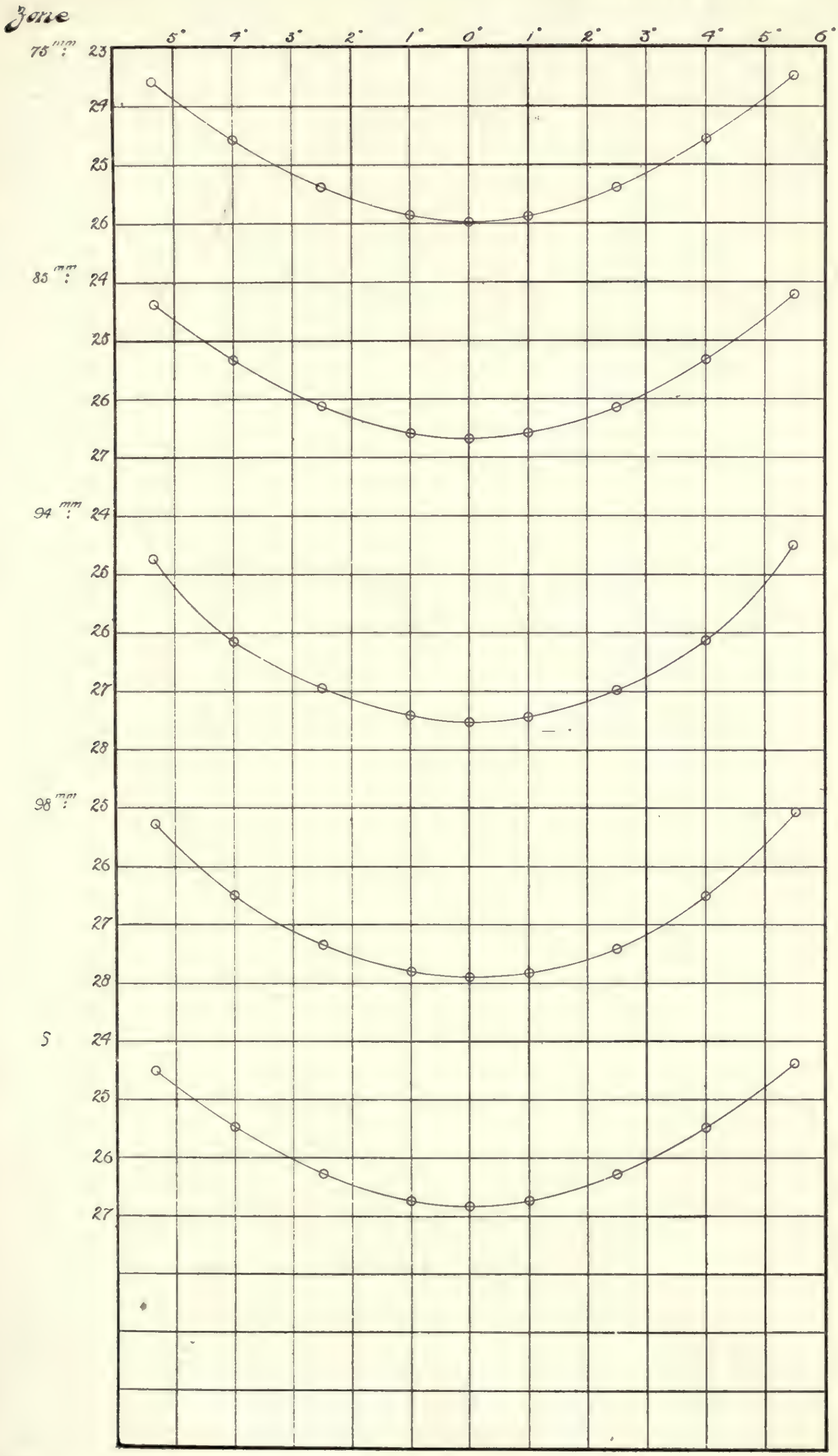


FIG. 44—Curvature of Field at different Zones.

chromatic plates were substituted for the Seed Process plates and a yellow screen was placed just above the plate-holder to cut out the blue and violet light. The Cramer plate was used as it has a band of sensitiveness in the yellow-green light about λ 5650, as well as the band of sensitiveness to blue and violet light possessed by all plates. Three exposures were made within the focus and three without, their positions being:

Position L, 50′ from centre to south.
" M, at centre.
" N, 50′ from centre to north.

The exposure in each case was 5 minutes.

Comparing these with positions A to I, we find the aberration less by about 0·6 mm.

Position L	showing	negative	aberration	of	2·77 mm.
" M	"	"	"		3·03 mm.
" N	"	"	"		2·78 mm.

But it is not small enough to indicate any special adjustment of the lens surface to yellow light. The uniformity of the aberration is shown in *L, M, N*, Fig. 42. The astigmatism is similar to that shown by the Seed Process plate.

A uniform increase of about 3·5 mm. in the focus, as compared with the blue light, is due partly to refraction of the light in passing through the yellow screen. The screen being about 6 mm. thick, the refraction would lengthen the focus by about 2 mm., the refractive index of glass being about 1·57. The remaining 1·5 mm. is due to the difference in focus of blue and yellow light.

Combining the results of positions A to I (see table XIV.), we have the focus of each zone of the lens at nine different points extending from 5°·3 on one side of the centre to 5°·5 on the other side. Figs. 43 and 44 show the curvature as given from these foci, the coordinates being the diameter of the field in degrees and the zonal foci in millimetres. As in the case of the aberration these curves are very uniform, indicating a difference of about 2·5 mm. between the focus at the edge of the field and that at the centre.

Since the zonal foci of the lens vary so much from the centre to the edge no one position of focus is suitable to all the lenses. To obtain a uniform field and at the same time get as sharp a definition as possible, we must study the effect produced by the various zones when out of focus.

If we set, for example, the camera at the focus of the zone with radius of 65 mm., then other zones will be out of focus and there will be discs or circles of confusion about each image. The density and size of these circles depend on the extent to which the several zones are out of focus and also on the area of these zones. The diameter of these circles of confusion may be determined as follows:—

$$d = 2r\frac{(F - F_0)}{F_0}$$

where d = diameter of circle of confusion,
r = radius of zone,
F = focus of zone,
F_0 = focus at which the camera is set.

This determines for us the circles of confusion but it does not give us any idea of the effect on the image. A circle of confusion of 20″ diameter and produced by a zone of 15 mm. radius would not be nearly so injurious to the image as one of the same diameter produced by a zone of 75 mm. radius. We see that simply determining the circles of confusion for the several zones will not give us the effect of the circles on the images, and so will not aid us in adjusting the camera to obtain the best images

possible under existing conditions. We must determine at what position of focus the lens is most efficient. The following formula by Hartmann gives a test for the efficiency of a lens at various foci:—

$$T = \frac{200000}{F_0^2} \cdot \frac{\Sigma r^2 (F - F_0)}{\Sigma r}$$

where T = efficiency of lens,
F = focus of zone,
F_0 = focus at which the camera is set,
r = radius of zone.

(100000 is introduced simply to transfer the decimal point and so avoid exceedingly small numbers.) According to this test an objective is moderately good when T is greater than 1·5, good when T is between 0·5 and 1·5, and exceedingly good when T is less than 0·5. But as this criterion of efficiency refers to telescope objectives where the field of view and angular aperture are small, it is not an accurate test for photographic objectives of wide aperture.

Using the above formula, the best positions of focus at the several positions, A, B, C, etc., were obtained. Table XV. gives these foci, the diameters of the circles of confusion, and the efficiency of the lens. Curve *S*, Fig. 44, shows the combined results for the several positions A to I. From this curve it may be concluded that the best uniform field would be obtained by setting the camera at 25·75 mm. or 26·0 mm.

Testing for Chromatic Aberration.

Although the foregoing tests revealed a much greater spherical aberration than is consistent with the production of good negatives, objection was taken to the statement that this aberration was the cause of the observed defects in the images. Accordingly it was decided to test for chromatic aberration also.

The camera was detached from the telescope and mounted on a table, the source of light being an arc-lamp about 400 yards distant. The spectrograph was placed with the slit at the focus of the camera which was in line with the collimation tube. A cardboard disc was placed over the camera objective, the light entering through two oblong openings, 3 mm. by 8·5 mm., symmetrically placed on a common diameter.

Exposures were made with the slit first inside the camera focus and then outside, isochromatic plates being used to obtain the *D* lines. Images of the slits in the disc were thus obtained as produced by light of various wave-lengths. By measuring the distances between these images at twelve points and applying the Hartmann formula the focus of the camera was obtained for twelve different wave-lengths, as shown in the following table:—

Wave-length.	Focus.
λ 5893, *D*	41·93 mm.
5500	41·24 "
5180	40·33 "
4880 H_β	39·30 "
4737	39·07 "
4520	38·62 "
4370	38·73 "
4230	38·79 "
4115	39·00 "
4020	39·71 "
3933, *K*	39·98 "
3780	40·88 "

Fig. 45 represents graphically the various foci and the chromatic aberration. The minimum focus is about $H\gamma$ and, while there is a range of 3·12 mm. in focus in the region between λ 5893 and λ 3780, there is less than 1 mm. range in the photographic region.

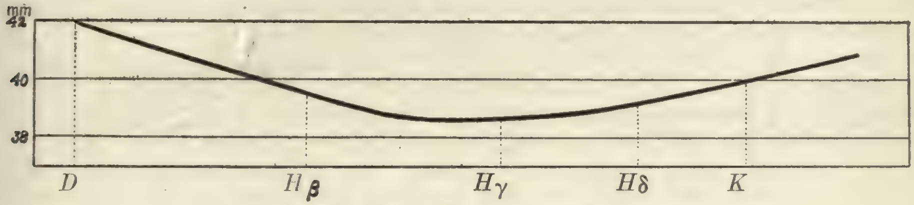


FIG. 45—Chromatic Aberration Curve.

Comparing this with the test for spherical aberration we have—

(*a*) Minimum spherical aberration of − 3·6 mm.

(*b*) Maximum chromatic aberration in photographic region of 1 mm.

Even if we allow for the chromatic aberration of 3 mm. at λ 5893, the light here is not rich enough in actinic properties to produce the observed halo. It seemed, therefore, unnecessary to continue the investigation *re* chromatic aberration.

Changing the Distance between the Components of the Outer Combination.

Prof. Hastings, of Yale University, who had been kept informed of the results of these tests, suggested that there might be sufficient internal reflection between the components of the objective to produce the observed halo and that this might be eliminated by increasing or decreasing the separation. Although we still felt that the defect was due to spherical aberration, this suggestion coming from the designer of the lens claimed our most careful attention and a series of tests were accordingly made. The original separation (one thickness of a postage stamp) was removed and new separations of various thicknesses used. Little blocks built up from bristol board were used until the best adjustment was obtained, after which hard rubber blocks were used.

The following table shows the tests and results:—

Date.	Separation of Components.	Focus.*	Spherical Aberration.	Description of Images.
1908.				
Jan	0·004 inches.	47·5 mm.	− 3·6 mm.	Described in first part of appendix.
1909.				
Jan. 12....	0·012 "	47·0 "	....	No change.
" 26....	Tissue paper.	47·5 "	....	"
Feb. 2.....	"	47·5 "	....	½″ and ¼″ discs were placed on lens to cut off outer portion, but there was very little improvement.
" 25.....	0·132 inches.	26·5 "	+ 2·4 mm.	Images about the same as originally.
Apr. 20.....	0·070 "	36·5 "	− 0·5 "	Images much improved. Halo greatly reduced.
May 25....	0·077 "	36·0 "	− 0·3 "	Images much the same as with .070 separation.

* Focus here refers to the scale on the camera tube.

Curve a, Fig. 46, shows the aberration with a separation of 0·004 inches, curve β shows the aberration with a separation of 0.132 inches, and curve γ shows the aberration with a separation of 0·070 inches. Figure 47 shows cuts of the Pleiades taken with the different separations.

Examining the above table it is seen that increasing the separation, shortened the focus and changed the aberration. Coincident with the change in aberration there was a decided change in the star images. Aberrations of − 3·6 mm. and + 2·4 mm. were accompanied by a very marked halo, while with an aberration of − 0·5 mm. the halo was negligible. Changing the separation to 0·070 inches has undoubtedly improved the objective as the field remained practically unchanged, and the halo was so small as to be neglected. But that this improvement has been effected by the removal of internal reflection does not seem at all probable. On the contrary, the above results seem to me to be but additional proof that the observed halo has been caused by spherical aberration, as was stated at the beginning of this appendix. It is not at all likely that the aberration and the halo would disappear simultaneously if the halo were caused by internal reflection.

Note.—Since the conclusion of the above work a communication has been received from the makers of the objective, stating that they also believe the defect to be due to spherical aberration and expressing their willingness to remove it without additional charge.

TABLE I.

ZONAL FOCI: POSITION A.

Radius of Zone	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm	45	0·6450	0·6826	21·86	....	+0·20
	135	0·6333	0·6938	21·47	21·66	−0·19
25	0	1·0432	1·1627	21·28	....	−0·37
	90	1·0746	1·1201	22·03	21·65	+0·38
35	45	1·5131	1·5651	22·12	....	+0·23
	135	1·4948	1·6115	21·66	21·89	−0·23
45	0	1·9259	2·0621	21·73	....	−0·44
	90	1·9921	1·9715	22·62	22·17	+0·45
55	45	2·4355	2·3590	22·86	....	+0·26
	135	2·4166	2·4523	22·34	22·60	−0·26
65	0	2·8795	2·8646	22·56	....	−0·05
	90	2·9851	2·7288	22·66	22·61	+0·05
75	22·5	3·4195	3·1358	23·47	....	−0·15
	67·5	3·5344	3·0497	24·16	....	+0·54
	112·5	3·4794	3·1066	23·77	....	+0·15
	157·5	3·3935	3·2266	23·07	23·62	−0·55
85	45	4·0807	3·3663	24·66	....	+0·29
	135	4·0195	3·4899	24·09	24·37	−0·28
94	0	4·5566	3·7376	24·72	....	....
	90	....	....	....	24·72	....
98	22·5	4·8567	3·7280	25·46	....	+0·20
	67·5	....	....	....	....	....
	112·5	....	....	....	....	....
	157·5	4·8157	3·8320	25·06	25·26	−0·20

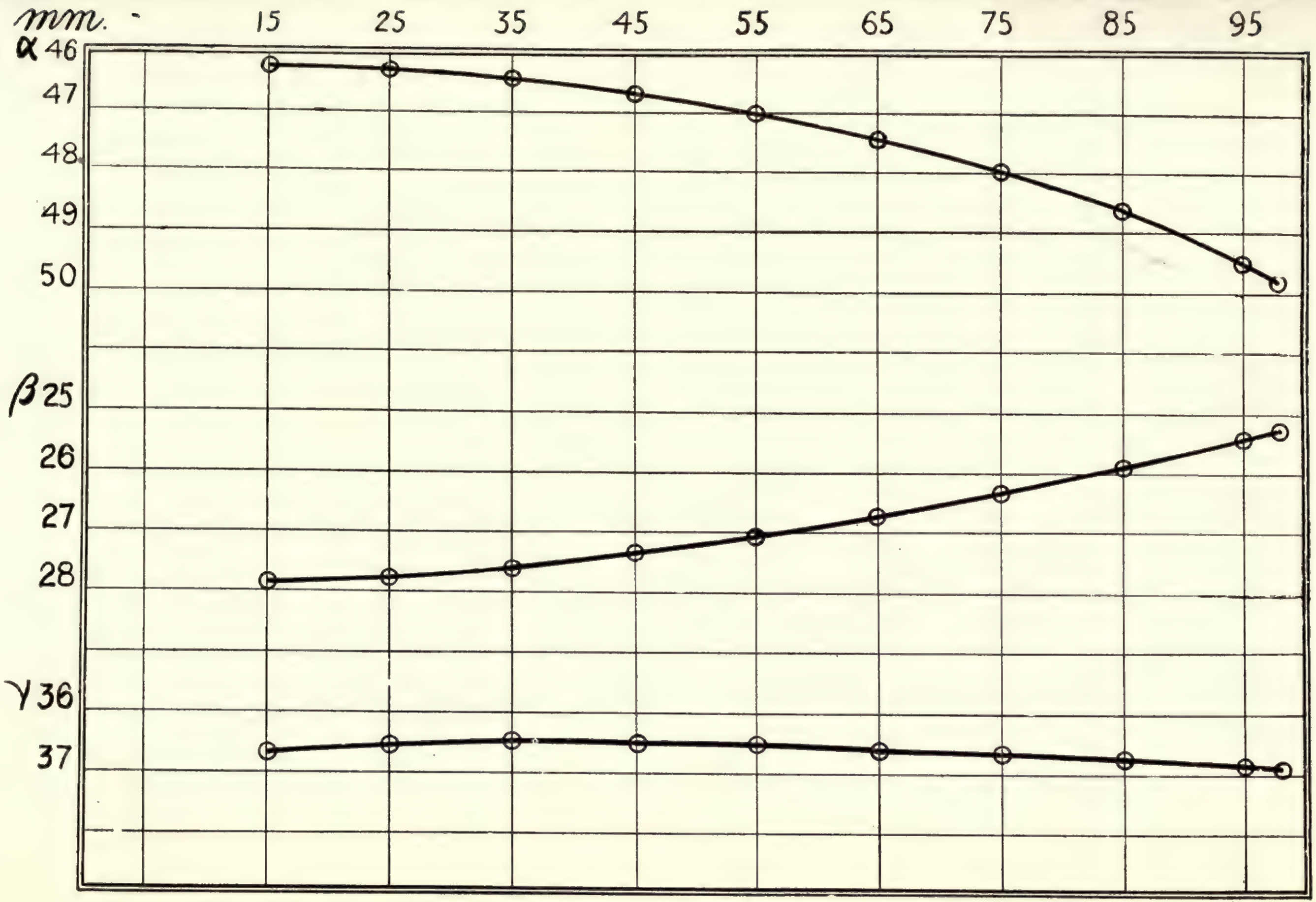
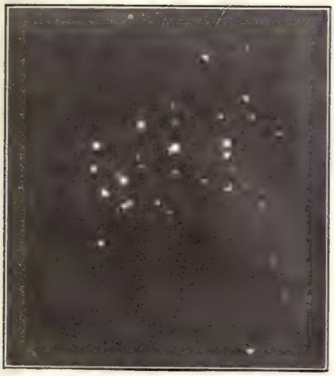


FIG. 46—Zonal Differences of Focus.



Focus 47·0
Separation—Tissue Paper.
No Disc.

Focus 47·0
Separation—Tissue Paper.
$\frac{1}{4}$-in. Disc.

Focus 26·5
Separation—0·132 inches.

Focus 36·5
Separation—0·070 inches.

FIG. 47—Star Photographs at Different Separations.

TABLE II.

ZONAL FOCI: POSITION B.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm			
15 mm	45	0·6694	0·6536	22·77		+0·08
	135	0·6625	0·6555	22·62	22·69	−0·07
25	0	1·1061	1·1020	22·54		−0·22
	90	1·1238	1·0793	22·99	22·76	+0·23
35	45	1·5766	1·5057	23·02		+0·10
	135	1·5740	1·5298	22·82	22·92	−0·10
45	0	2·0353	1·9518	22·97		−0·25
	90	2·0708	1·8979	23·48	23·22	+0·26
55	45	2·5308	2·2741	23·70		+0·14
	135	2·5368	2·3375	23·42	23·56	−0·14
65	0	3·0385	2·7147	23·77		−0·22
	90	3·0850	2·6503	24·21	23·99	+0·22
75	22·5	3·5797	2·9946	24·50		−0·07
	67·5	3·6489	2·9584	24·85		+0·28
	112·5	3·6175	2·9892	24·64		+0·07
	157·5	3·5760	3·0462	24·30	24·57	−0·27
85	45	4·2251	3·2505	25·43		+0·12
	135	4·2075	3·3061	25·20	25·31	−0·11
94	0	4·7707	3·5186	25·90		−0·28
	90	4·8840	3·4186	26·47	26·18	+0·29
98	22·5	5·0522	3·5470	26·44		−0·07
	67·5	5·0494	3·4591	26·71		+0·20
	112·5	5·0914	3·5125	26·63		+0·12
	157·5	5·0384	3·5950	26·26	26·51	−0·25

TABLE III.

ZONAL FOCI: POSITION C.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm	45	0·7003	0·6365	23·57		−0·04
	135	0·7023	0·6334	23·66	23·61	+0·05
25	0	1·1571	1·0546	23·54		−0·10
	90	1·1701	1·0470	23·75	23·64	+0·11
35	45	1·6446	1·4542	23·88		+0·05
	135	1·6394	1·4625	23·78	23·83	−0·05
45	0	2·1303	1·8615	24·02		−0·10
	90	2·1444	1·8404	24·22	24·12	+0·10
55	45	2·6238	2·2009	24·47		+0·05
	135	2 6415	2·2368	24·37	24·42	−0·05
65	0	3·1652	2·5791	24·80		−0·05
	90	3·1857	2·5686	24·91	24·85	+0·06
75	22·5	3·7187	2·8718	25·39		−0·01
	67·5	3·7533	2·8700	25·50		+0·10
	112·5	3·7401	2·8848	25·40		0·00
	157·5	3 7206	2·8957	25 30	25·40	−0·10
85	45	4·3530	3 1223	26·20		+0·07
	135	4·3522	3 1638	26·06	26·13	−0·07
94	0	4·9560	3·3371	26·89		−0·09
	90	5·0073	3·3159	27·07	26·98	+0·09
98	22·5	5·2 15	3 3850	27·32		−0·04
	67·5	5 2741	3·3635	27·48		+0·12
	112·5	5·2528	3·3800	27·38		+0·02
	157·5	5·2405	3·4089	27·26	27·36	−0·10

TABLE IV.

ZONAL FOCI: POSITION D.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15mm.	45	0·7204	0·6208	24·17	...	−0·03
	135	0·7128	0·6106	24·24	24·20	+0·04
25	0	1·1883	1·0255	24·15	...	−0·02
	90	1·1963	1·0292	24·19	24·17	+0·02
35	45	1·6786	1·4273	24·32	...	+0·04
	135	1·6764	1·4340	24·25	24·28	−0·03
45	0	2·1796	1·8131	24·57	...	−0·02
	90	2·1843	1·8102	24·61	24·59	+0·02
55	45	2·6726	2·1618	24·88	...	−0·01
	135	2·7039	2·1805	24·91	24·89	+0·02
65	0	3·2398	2·5165	25·33	...	−0·02
	90	3·2503	2·5140	25·37	25·35	+0·02
75	22·5	3·7991	2·8022	25·90	...	+0·03
	67·5	3·8159	2·8151	25·90	...	+0·03
	112·5	3·8110	2·8295	25·83	...	−0·04
	157·5	3·8084	2·8193	25·86	25·87	−0·01
85	45	4·4340	3·0715	26·58	...	+0·01
	135	4·4454	3·0862	26·56	26·57	−0·01
94	0	5·0594	3·2538	27·39	...	−0·03
	90	5·0882	3·2528	27·45	27·42	+0·03
98	22·5	5·3326	3·2971	27·81	...	+0·01
	67·5	5·3435	3·3117	27·78	...	−0·02
	112·5	5·3394	3·3005	27·81	...	+0·01
	157·5	5·3453	3·3101	27·79	27·80	−0·01

TABLE V.

ZONAL FOCI: POSITION E.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15mm.	45	0·7243	0·6159	24·32	...	+0·03
	135	0·7189	0·6145	24·26	24·29	−0·03
25	0	1·1937	1·0189	24·28	...	−0·02
	90	1·2020	1·0215	24·33	24·30	+0·03
35	45	1·6884	1·4238	24·41	...	+0·01
	135	1·6907	1·4277	24·40	24·40	0·00
45	0	2·1965	1·8049	24·70	...	0·00
	90	2·1948	1·8038	24·70	24·70	0·00
55	45	2·6918	2·1478	25·03	...	+0·02
	135	2·7202	2·1765	25·00	25·01	−0·01
65	0	3·2594	2·5023	25·46	...	0·00
	90	3·2631	2·5050	25·46	25·46	0·00
75	22·5	3·8166	2·7969	25·97	...	−0·01
	67·5	3·8365	2·8062	25·99	...	+0·01
	112·5	3·8381	2·8112	25·97	...	−0·01
	157·5	3·8347	2·8057	25·99	25·98	+0·01
85	45	4·4596	3·0610	26·68	...	0·00
	135	4·4751	3·0733	26·68	26·68	0·00
94	0	5·0876	3·2357	27·51	...	0·00
	90	5·1113	3·2509	27·51	27·51	0·00
98	22·5	5·3623	3·2966	27·87	...	−0·02
	67·5	5·3789	3·2991	27·89	...	0·00
	112·5	5·3738	3·3000	27·88	...	−0·01
	157·5	5·3729	3·2913	27·91	27·89	+0·02

TABLE VI.

ZONAL FOCI: POSITION F.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm.	45	0·7396	0·6078	24·70	....	+0·11
	135	0·7315	0·6130	24·48	24·59	−0·11
25	0	1·2242	1·0149	24·60	....	−0·04
	90	1·2304	1·0127	24·68	24·64	+0·04
35	45	1·7274	1·4155	24·73	....	+0·01
	135	1·7267	1·4160	24·72	24·72	0·00
45	0	2·2431	1·7927	25·01	....	−0·03
	90	2·2483	1·7875	25·07	25·04	+0·03
55	45	2·7507	2·1330	25·35	....	+0·01
	135	2·7761	2·1567	25·33	25·34	−0·01
65	0	3·3281	2·4797	25·79	....	−0·01
	90	3·3424	2·4826	25·82	25·80	+0·02
75	22·5	3·9033	2·7731	26·31	....	−0·02
	67·5	3·9215	2·7751	26·35	....	+0·02
	112·5	3·9230	2·7794	26·34	....	+0·01
	157·5	3·9134	2·7826	26·30	26·33	−0·03
85	45	4·5513	3·0286	27·02	....	0·00
	135	4·5709	3·0376	27·03	27·02	+0·01
91	0	5·1894	3·2095	27·80	....	−0·04
	90	5·2240	3·2063	27·88	27·84	+0·04
98	22·5	5·4615	3·2621	28·17	....	−0·05
	67·5	5·4831	3·2539	28·24	....	+0·02
	112·5	5·4846	3·2448	28·27	....	+0·05
	157·5	5·4797	3·2630	28·21	28·22	−0·01

TABLE VII.

ZONAL FOCI: POSITION G.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm.	45	0·7307	0·6203	24·29	....	+0·04
	135	0·7256	0·6228	24·22	24·25	−0·03
25	0	1·1958	1·0336	24·14	....	−0·10
	90	1·2129	1·0297	24·34	24·24	+0·10
35	45	1·7039	1·4425	24·37	....	+0·01
	135	1·6995	1·4409	24·35	24·36	−0·01
45	0	2·2025	1·8339	24·55	....	−0·10
	90	2·2164	1·8137	24·75	24·65	+0·10
55	45	2·7191	2·1758	25·00	....	+0·03
	135	2·7339	2·1962	24·95	24·97	−0·02
65	0	3·2652	2·5402	25·31	....	−0·12
	90	3·2975	2·5100	25·55	25·43	+0·12
75	22·5	3·8418	2·8348	25·89	....	−0·07
	67·5	3·8710	2·8123	26·06	....	+0·10
	112·5	3·8743	2·8281	26·01	....	+0·05
	157·5	3·8565	2·8481	25·88	25·96	−0·08
85	45	4·5039	3·0808	26·72	....	+0·04
	135	4·5072	3·1024	26·65	26·68	−0·03
94	0	5·1090	3·2893	27·38	....	−0·13
	90	5·1685	3·2472	27·64	27·51	+0·13
98	22·5	5·3913	3·3340	27·80	....	−0·08
	67·5	5·4340	3·3009	28·00	....	+0·12
	112·5	5·4298	3·3093	27·96	....	+0·08
	157·5	5·3990	3·3450	27·78	27·88	−0·10

TABLE VIII.

Zonal Foci: Position H.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm	45	0·7033	0·6505	23·38	....	+0·04
	135	0·7010	0·6528	23·30	23·34	−0·04
25........	0	1·1515	1·0961	23·05	....	−0·31
	90	1·1775	1·0610	23·67	23·36	+0·31
35........	45	1·6507	1·4920	23·64	....	+0·07
	135	1·6408	1·5005	23·50	23·57	−0·07
45........	0	2·1198	1·9152	23·64	....	−0·27
	90	2·1580	1·8560	24·19	23·91	+0·28
55........	45	2·6321	2·2501	24·26	....	+0·06
	135	2·6458	2·2870	24·14	24·20	−0·06
65........	0	3·1527	2·6581	24·41	....	−0·26
	90	3·2126	2·5830	24·94	24·67	+0·27
75........	22·5	3·7121	2·9610	25·03	....	−0·16
	67·5	3·7705	2·9036	25·42	....	+0·23
	112·5	3·7646	2·9178	25·35	....	+0·16
	157·5	3·7126	2·9823	24·95	25·19	−0·24
85........	45	4·3805	3·1994	26·01	....	+0·06
	135	4·3703	3·2255	25·89	25·95	−0·06
94........	0	4·9372	3·4590	26·46	....	−0·33
	90	5·0597	3·3340	27·13	26·79	+0·34
98	22·5	5·2258	3·4928	26·97	....	−0·19
	67·5	5·3153	3·4031	27·43	....	+0·27
	112·5	5·3021	3·4164	27·37	....	+0·21
	157·5	5·2219	3·5158	26·89	27·16	−0·27

TABLE IX.

Zonal Foci: Position I.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm	45	0·6675	0·6798	22·29	....	+0·14
	135	0·6580	0·6869	22·02	22·15	−0·13
25........	0	1·0786	1·1508	21·77	....	−0·53
	90	1·1344	1·1005	22·84	22·30	+0·54
35........	45	1·5761	1·5551	22·65	....	+0·17
	135	1·5518	1·5765	22·32	22·48	−0·16
45........	0	1·9937	2·0341	22·27	....	−0·55
	90	2·0805	1·9245	23·38	22·82	+0·56
55........	45	2·5249	2·3421	23·34	....	+0·16
	135	2·5131	2·3998	23·02	23·18	−0·16
65	0	2·9778	2·8323	23·06	....	−0·59
	90	3·1123	2·6623	24·25	23·65	+0·60
75........	22·5	3·5401	3·1225	23·91	....	−0·30
	67·5	3·6580	2·9877	24·77	....	+0·56
	112·5	3·6314	3·0360	24·51	....	+0·30
	157·5	3·5107	3·1646	23·67	24·21	−0·54
85........	45	4·2245	3·3275	25·17	....	+0·20
	135	4·1720	3·4060	24·77	24·97	−0·20
94........	0	4·7029	3·6958	25·20	....	....
	90	....	....	....	25·20	....
98........	22·5	5·0145	3·6885	25·93	....	+0·15
	67·5	....	....	....	....	....
	112·5	....	....	....	....	....
	157·5	4·9712	3·7578	25·63	25·78	−0·15

TABLE X.

Zonal Foci: Position L.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm	45	0·8580	0·5011	28 41	....	+0·03
	135	0·8478	0·4980	28·35	28·38	−0·03
25	0	1·4122	0·8305	28·34	....	−0·02
	90	1·4257	0·8345	28·38	28·36	+0·02
35	45	2·0004	1·1616	28·47	....	−0·04
	135	2·0018	1·1533	28·55	28·51	+0·04
45	0	2·5920	1·4647	28·75	....	+0·03
	90	2·5883	1·4712	28·69	28·72	−0·03
55	45	3·1567	1·7504	28·95	....	−0·05
	135	3·1968	1·7537	29·06	29·00	+0·06
65	0	3·8030	2·0479	29·25	....	−0·01
	90	3·8094	2·0455	29·28	29·26	+0·02
75	22·5	4·4142	2·2996	29·59	....	−0·08
	67·5	4·4469	2·2925	29·69	....	+0·02
	112·5	4·4305	2·2881	25·68	....	+0·01
	157·5	4·4525	2·2920	29·71	29·67	+0·04
85	45	5·1293	2·5171	30·19	....	−0·05
	135	5·1351	2·4940	30·29	30·24	+0·05
94	0	5·7911	2·6695	30·81	....	−0·04
	90	5·8120	2·6555	30·89	30·85	+0·04
98	22·5	6·0783	2·7200	31·09	....	−0·06
	67·5	6·0767	2·6950	31·17	....	+0·02
	112·5	6·0729	2·6946	31·17	....	+0·02
	157·5	6·0908	2·7050	31·16	31·15	+0·01

TABLE XI.

Zonal Foci: Position M.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm	45	0·8617	0·5145	28·18	....	+0·02
	135	0·8519	0·5111	28·13	28·16	−0·03
25	0	1·4154	0·8238	28·44	....	−0·02
	90	1·4309	0·8295	28·49	28·46	+0·03
35	45	2·0053	1·1647	28·47	....	−0·06
	135	2·0039	1·1490	28·60	28·53	+0·07
45	0	2·5951	1·4685	28·74	....	−0·01
	90	2·5865	1·4601	28·76	28·75	+0·01
55	45	3·1740	1·7598	28·95	....	−0·08
	135	3·2043	1·7498	29·11	29·03	+0·08
65	0	3·8230	2·0360	29·36	....	0·00
	90	3·8263	2·0381	29·36	29·36	0·00
75	22·5	4·4467	2·2842	29·73	....	+0·03
	67·5	4·4591	2·2817	29·59	....	−0·11
	112·5	4·4541	2·2803	29·76	....	+0·06
	157·5	4·4353	2·2760	29·74	29·70	+0·04
85	45	5·1375	2·4931	30·30	....	+0·05
	135	5·1476	2·5197	30·21	30·25	−0·04
94	0	5·8073	2·6596	30·86	....	−0·01
	90	5·8189	2·6630	30·87	30·87	0·00
98	22·5	6·0981	2·6932	31·21	....	+0·02
	67·5	6·1118	2·7059	31·19	....	0·00
	112·5	6·0862	2·7090	31·14	....	−0·05
	157·5	6·0983	2·6950	31·21	31·19	+0·02

TABLE XII.

ZONAL FOCI: POSITION N.

Radius of Zone.	φ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15mm	45	0·8573	0·4968	28·49	....	+0·07
	135	0·8578	0·5042	28·34	28·42	−0·08
25...................	0	1·4272	0·8332	28·41	....	−0·05
	90	1·4232	0·8235	28·51	28·46	+0·05
35.......	45	2·0043	1·1518	28·58	....	−0·02
	135	2·0138	1·1536	28·61	28·60	+0·01
45.	0	2·6017	1·4565	28·85	....	+0·04
	90	2·5934	1·4642	28·76	28·81	−0·05
55...................	45	3·1837	1·7478	29·05	... .	0·00
	135	3·2112	1·7647	29·04	29·05	−0·01
65...................	0	3·8245	2·0250	29·42	... .	+0·01
	90	3·8307	2·0334	29·40	29·41	−0·01
75......	22·5	4·4507	2·2902	29·71	....	−0·04
	67·5	4·4655	2·2819	29·78	....	+0·03
	112·5	4·4729	2·2797	29·81	... .	+0·06
	157·5	4·4521	2·2895	29·72	29·75	−0·03
85...................	45	5·1540	2·5082	30·27	....	−0·02
	135	5·1560	2·4981	30·31	30·29	+0·02
94.................	0	5·8248	2·6439	30·95	....	+0·03
	90	5·8086	2·6549	30·88	30·92	−0·04
98...................	22·5	6·0993	2·6965	31·20	....	0·00
	67·5	6·1101	2·7062	31·19	....	−0·01
	112·5	6·1006	2·6947	31·21	....	+0·01
	157·5	6·0933	2·6951	31·20	31·20	0·00

TABLE XIII.

ZONAL FOCI: POSITION R.

Radius of Zone.	φ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15mm	45	0·6950	0·6533	23·20	....	+0·18
	135	0·6707	0·6506	22·84	23·02	−0·18
25.........	0	1·1187	1·1000	22·69	....	−0·23
	90	1·1413	1·0780	23·14	22·92	+0·23
35	45	1·6051	1·5079	23·20	....	+0·08
	135	1·5904	1·5168	23·03	23·12	−0·09
45............	0	2·0648	1·9508	23·14	....	−0·30
	90	2·0968	1·8769	23·74	23·44	+0·30
55	45	2·5811	2·2793	23·90	....	+0·12
	135	2·5683	2·3143	23·67	23·78	−0·11
65...................	0	3·0716	2·7009	23·94	....	−0·28
	90	3·1285	2·6173	24·50	24·22	+0·28
75	22·5	3·6463	2·9964	24·70	....	−0·09
	67·5	3·6927	2·9238	25·11	....	+0·32
	112·5	3·6642	2·9616	24·89	. ...	+0·10
	157.5	3·6180	3·0345	24·47	24·79	−0·32
85...................	45	4·2992	3·2352	25·68	....	+0·15
	135	4·2542	3·2864	25·39	25·53	−0·14
94...................	0	4·8501	3·5156	26·09	....	−0·30
	90	4·9240	3·3800	26·68	26·39	+0·29
98.....	22·5	5·1406	3·5317	26·67	....	−0·12
	67·5	5·2145	3·4394	27·12	....	+0·33
	112·5	5·1649	3·4780	26·89	....	+0·10
	157·5	5·1125	3·5791	26·47	26·79	−0·32

TABLE XIV.

ZONAL FOCI.

Radius of Zone.	Position.					
	A	B	C	D	E	F
15 mm	21·66	22·69	23·61	24·20	24·29	24·59
25	21·65	22·76	23·64	24·17	24·30	24·64
35	21.89	22·92	23·83	24·28	24·40	24·72
45	22·17	23·22	24·12	24·59	24·70	25·04
55	22·60	23·56	24·42	24·89	25·01	25·34
65	22·61	23·99	24·85	25·35	25·46	25·80
75	23·62	24·57	25·40	25·87	25·98	26·33
85	24·47	25·31	26·13	26·57	26·68	27·02
94	24·72	26·18	26·98	27·42	27·51	27·84
98	25·26	26·51	27·36	27·80	27·89	28·22
	G	H	I	L	M	N
15 mm	24·25	23·34	22·15	28·38	28·16	28·42
25	24·24	23·36	22·30	28·36	28·46	28·46
35	24·36	23·57	22·48	28·51	28·53	28·60
45	24·65	23·91	22·82	28·72	28·75	28·81
55	24·97	24·20	23·18	29·00	29·03	29·05
65	25·43	24·67	23·65	29·26	29·36	29·41
75	25·96	25·19	24·21	29·67	29·70	29·75
85	26·68	25·95	24·97	30·24	30·25	30·29
94	27·51	26·79	25·20	30·85	30·87	30·92
98	27·88	27·16	25·78	31·15	31·19	31·20

TABLE XV.

Plate.	Best Focus.	Confusion Circle.	Efficiency.
		"	
A	24·5	44·2	11·46
B	25·5	38·5	13·43
C	26·25	39·2	13·11
D	26·75	37·9	13·01
E	26·8	38·5	12·77
F	27·00	43·1	12·56
G	26·7	41·7	12·71
H	26·00	41·00	13·08
I	25·00	36·00	10·52
L	30·20	33·3	9·64
M	30·25	33·0	9·47
N	30·30	31·7	9·38

TABLE XVI.

ZONAL TEST.

Settings 6·5 & 51·5; Separation 0·132 inches.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.
	°	mm.	mm.		
15 mm.	45	0·6422	0·7178	21·25	
	135	0·6389	0·7130	21·27	21·26
25	0	1·0595	1·1848	21·24	
	90	1·0605	1·1895	21·21	21·22
35	45	1·4779	1·6885	21·00	
	135	1·4683	1·6827	20·97	20·98
45	0	1·8743	2·1880	20·76	
	90	1·8729	2·1754	20·82	20·79
55	45	2·2487	2·6728	20·56	
	135	2·2606	2·6841	20·57	20·56
65	0	2·6086	3·2090	20·18	
	90	2·6180	3·2997	19·91	20·04
75	22·5	2·9475	3·7395	19·83	
	67·5	2·9587	3·7468	19·86	
	112·5	2·9633	3·7468	19·87	
	157·5	2·9505	3·7495	19·82	19·84
85	45	3·2795	4·3160	19·43	
	135	3·2858	4·3213	19·44	19·43
94	0	3·5285	4·8575	18·93	
	90	3·5398	4·8555	18·97	18·95
98	22·5	3·6505	5·0963	18·78	
	67·5	3·6643	5·0935	18·83	
	112·5	3·6723	5·0755	18·89	
	157·5	3·6566	5·0691	18·86	18·84

TABLE XVII.

ZONAL TEST.

Settings 16·5 & 61·5; Separation 0·070 inches.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.
	°	mm.	mm.		
15 mm.	45	0·6014	0·7362	20·23	
	135	0·5953	0·7372	20·10	20·16
25	0	0·9944	1·2348	20·07	
	90	0·9931	1·2375	20·03	20·05
35	45	1·3921	1·7460	19·96	
	135	1·3905	1·7501	19·93	19·95
45	0	1·7970	2·2300	20·08	
	90	1·7882	2·2236	20·06	20·07
55	45	2·1784	2·7251	19·99	
	135	2·1720	2·7159	19·99	19·99
65	0	2·5940	3·2068	20·12	
	90	2·5899	3·2110	20·09	20·11
75	22·5	2·9884	3·6893	20·14	
	67·5	2·9855	3·6896	20·13	
	112·5	2·9914	3·6926	20·14	
	157·5	2·9805	3·6919	20·10	20·13
85	45	3·4127	4·1765	20·24	
	135	3·4084	4·1754	20·22	20·23
94	0	3·7945	4·5940	20·36	
	90	3·7910	4·6020	20·33	20·35
98	22·5	3·9770	4·7611	20·48	
	67·5	3·9740	4·7611	20·47	
	112·5	3·9755	4·7650	20·47	
	157·5	3·9755	4·7735	20·45	20·47

TABLE XVIII.

SETTINGS 16·5 AND 61·5; 0·077 SEPARATION

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.
	°	mm.	mm.		
15	45	0·5717	0·7561	19·38	
	135	0·5830	0·7540	....	19·38
25	0	0·9550	1·2645	19·36	
	90	0·9549	1·2662	19·35	19·36
35	45	1·3335	1·7745	19·31	
	135	1·3365	1·7831	19·28	19·30
45	0	1·7208	2·2832	19·34	
	90	1·7228	2·2750	19·39	19·37
55	45	2·0918	2·7819	19·31	
	135	2·0909	2·7681	19·36	19·34
65	0	2·4909	3·2762	19·44	
	90	2·4915	3·2844	19·41	19·43
75	22·5	2·8593	3·7774	19·39	
	67·5	2·8637	3 7804	19·39	
	112·5	2·8707	3·7829	19·42	
	157·5	2·8585	3·7694	19·41	19·40
85	45	3·2567	4·2874	19·43	
	135	3·2742	4·2702	19·53	19·48
94	0	3·6387	4·7187	19·59	
	90	3·6456	4·7240	19·60	19·60
98	22·5	3·7929	4·9030	19·63	
	67·5	3·7942	4·9054	19·63	
	112·5	3·8191	4·8918	....	
	157·5	3·7988	4·8958	19 66	19·64

APPENDIX E.

OBSERVING RECORDS AND DETAILED MEASURES OF β ORIONIS, θ AQUILÆ, ϵ HERCULIS, η BOÖTIS, α CORONÆ BOREALIS AND δ AQUILÆ.

P.—Plaskett.
H.—Harper.
C.—Cannon.
P[1]—Parker.

β ORIONIS.

RECORD OF SPECTROGRAMS.

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure. G. M. T.		Duration.	Hour Angle at end.		Temperature Centigrade. Room. Beginning.	Room. End.	Prism Box. Beginning.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1908.	h.	m.	m.	h.	m.								
β Orionis ...	1241a	IL	Seed 27 ..	Jan. 20..	15	03	2½		52 W.	– 7·0	....	– 6·9	– 6·9	·001	Poor	P	
" ...	1241b	"	" ..	" 20..	15	05	"		55 "	....	....	"	"	"	"	P	
" ...	1241c	"	" ..	" 20..	15	07½	"		57½ "	....	....	"	"	"	"	P	
" ...	1242a	"	" ..	" 20..	15	12½	"	1	02½ "	....	....	"	"	"	"	P	
" ...	1242b	"	" ..	" 20..	15	15	"	1	05 "	....	....	"	"	"	"	P	
" ...	1242c	"	" ..	" 20..	15	17½	"	1	07½ "	....	....	"	"	"	"	P	
" ...	1243a	"	" ..	" 20..	15	25	1½	1	16 "	....	....	"	"	·0015	"	P	
" ...	1243b	"	" ..	" 20..	15	27	"	1	18 "	....	....	"	"	"	"	P	
" ...	1243c	"	" ..	" 20..	15	29	"	1	20 "	....	....	"	"	"	"	P	
" ...	1244a	"	" ..	" 20..	15	45	1¼	1	36 "	....	....	"	"	"	"	P	
" ...	1244b	"	" ..	" 20..	15	47	"	1	38 "	....	....	"	"	"	"	P	
" ...	1244c	"	" ..	" 20..	15	49	"	1	40 "	....	....	"	"	"	"	P	
" ...	1245a	"	" ..	" 20..	15	52	50s	1	43 "	....	....	"	"	·002	"	P	
" ...	1245b	"	" ..	" 20..	15	53	"	1	44 "	....	....	"	"	"	"	P	
" ...	1245c	"	" ..	" 20..	15	54	"	1	45 "	....	....	"	"	"	"	P	
" ...	1247a	"	" ..	" 20..	16	16	40s	2	05 "	....	....	"	"	·003	"	P	
" ...	1247b	"	" ..	" 20..	16	17	"	2	06 "	....	....	"	"	"	"	P	
" ...	1247c	"	" ..	" 20..	16	18	"	2	07 "	....	....	"	"	"	"	P	
" ...	1248a	"	" ..	" 20..	16	26	"	2	15 "	....	....	"	"	"	"	P	
" ...	1248b	"	" ..	" 20..	16	27	"	2	16 "	....	....	"	"	"	"	P	
" ...	1248c	"	" ..	" 20..	16	28	"	2	17 "	....	....	"	"	"	"	P	
" ...	1249a	"	" ..	" 20..	16	35	1	2	23 "	....	....	"	"	·002	"	P	
" ...	1249b	"	" ..	" 20..	16	37	"	2	25 "	....	....	"	"	"	"	P	
" ...	1249c	"	" ..	" 20..	16	39	"	2	27 "	....	– 6·5	"	"	"	"	P	
" ...	1285a	IIIS	" ..	" 27..	15	46	5	2	00 "	– 13·0	– 13·0	– 16·0	– 16·0	·001	Good. ..	P	
" ...	1285b	"	" ..	" 27..	15	51	"	2	05 "	"	"	"	"	"	"	P	

" ...	1285c	"	" ..	" 27..	15 56	"	2 10 "	"	"	"	"	"	"	P	
" ...	1286a	"	" .	" 27..	16 04	"	2 18 "	"	"	"	"	·0015	" ...	P	
" ...	1286b	"	" ..	" 27..	16 09	"	2 23 "	"	"	"	"	"	"	P	
" ...	1286c	"	" ..	" 27..	16 14	"	2 28 "	"	"	"	"	"	"	P	
" ...	1289a	"	" ..	" 27..	17 14	2½	3 30 "	"	"	"	"	·002	"	P	
" ...	1289b	"	" ..	" 27..	17 17	"	3 33 "	"	"	"	"	"	"	P	
" ..	1289c	"	" ..	" 27..	17 20	"	3 36 "	"	"	"	"	"	"	P	
" ...	1290a	"	" ..	" 27..	17 25	"	3 41 "	"	"	"	"	"	"	P	
" ...	1290b	"	" ..	" 27..	17 28	"	3 44 "	"	"	"	"	"	"	P	
" ...	1290c	"	" ..	" 27..	17 31	"	3 47 "	"	"	"	"	"	"	P	
" ...	1405	ILJL	" ..	Mar. 20..	11 51	13	1 37 "	− 3·4	− 3·4	1·2	1·2	·001	Fair......	P	
" ...	1406	"	" ..	" 20..	12 07	14	1 50 "	"	− 4·0	"	"	"	......	P	
" ...	1407	"	" ..	" 20..	12 21	13	2 04 "	− 4·0	− 4·3	"	1·1	"	....	P	
" ...	1408	"	" ..	" 20..	12 32	11	2 15 "	− 4·3	− 5·2	1·1	"	"	to ...	P	
" ...	1409	"	" ..	" 20..	12 46	14	2 30 "	− 5·2	− 5·2	"	1·0	"	....	P	
" ...	1410	"	" ..	" 20..	13 00	11	2 45 "	"	− 6·0	1·0	"	"	...	P	
" ...	1411	"	" ..	" 20..	13 12	9	2 52 "	− 6·0	− 6·5	1·0	0·9	·0015	.....	P	
" ...	1412	"	" ..	" 20 .	13 25	15	3 10 "	− 6·5	− 6·8	0·9	0·8	"	good	P	Off part of time.
" ...	1413	"	" ..	" 20..	13 47	8	3 30 "	− 6·8	− 7·0	0.8	0·8	"	....	P	
" ...	1414	"	" ..	" 20..	13 57	11	3 40 "	− 7·0	− 6·5	"	"	"	....	P	
" ...	1426a	"	" ..	" 24..	12 03	10	2 02 "	1·0	1·0	5·1	5·1	·002	Fair......	P	
" ...	1427	"	" ..	" 24..	12 14	8	2 12 "	....	....	....	....	"	"	P	
" ...	1428	"	" ..	" 24..	12 23	8	2 20 "	....	....	....	....	"	"	P	
" ...	1429	"	" ..	" 24..	12 32	9	2 30 "	− 2·0	....	5·0	....	"	"	P	
" ...	1430	"	" ..	" 24..	12 42	9	2 40 "	....	....	....	....	"	"	P	
" ...	1431	"	" ..	" 24..	12 52	8	2 50 "	− 3·4	....	4·9	....	"	"	P	
" ...	1433	"	" ..	" 24..	13 16	7	3 15 "	....	....	....	....	·003	"	P	
" ...	1434	"	" ..	" 24..	13 32	6	3 30 "	− 4·5	....	4·7	....	"	"	P	
" ...	1435	"	" ..	" 24..	13 39	6	3 36 "	....	....	....	....	"	"	P	
" ...	1436	"	" ..	" 24..	13 46	6	3 44 "	....	....	....	....	"	. ....	P	
" ...	1437	"	" ..	" 24..	13 56	9	3 56 "	....	....	....	....	"	"	P	
" ...	1438	"	" ..	" 24..	14 07	10	4 05 "	− 5·0	− 5 0	4·6	4·6	"	"	P	
" ...	1439	"	" ..	" 30..	12 19	8	2 40 "	3·5	3·5	5·7	5·7	·0022	"	P	Slit intended for ·0018.
" ...	1440	"	" ..	" 30..	12 29	8	2 50 "	"	"	"	"	"	"	P	
" ...	1441	"	" ..	" 30..	12 38	9	3 00 "	3·5	3·3	5·7	5·7	·0022	"	P	
" ...	1442	"	" ..	" 30..	12 49	10	3 13 "	3·3	3·0	"	"	"	"	P	
" ...	1448	"	" ..	April 3..	12 16	9	2 57 "	− 2·8	− 3·2	1·7	1·7	·002	"	P	
" ...	1449	"	" ..	" 3..	12 28	10	3 10 "	− 3·2	− 3·8	"	"	"	"	P	
" ...	1450	"	" ..	" 3..	12 40	10	3 22 "	− 3·8	− 3·4	"	"	"	"	P	
" ...	1451	"	" ..	" 3..	12 53	10	3 35 "	− 3·4	− 3·1	"	"	"	"	P	
" ...	1457	"	" ..	" 4..	12 19	8	3 00 "	− 1·6	....	2·0	2·0	·0018	"	P	
" ...	1458	"	" ..	" 4..	12 28	8	3 10 "	"	....	"	"	"	"	P	
" ...	1459	"	" ..	" 4..	12 37	8	3 20 "	− 2·0	....	"	"	"	"	P	
" ...	1469	"	" ..	" 13..	12 10	10	3 30 "	5·8	....	9·7	....	·002	Good.	P	
" ...	1470	"	" ..	" 13..	12 22	10	3 42 "	....	....	....	....	"	"	P	
" ...	1471	"	" ..	" 13..	12 34	11	3 53 "	....	....	....	....	"	"	P	
" ...	1873	"	" ..	Sept. 7..	21 52	16	....	12·0	11·8	21·0	21·0	·0015	"	C	
" ...	1874	"	" ..	" 7..	22 10	19	....	11·8	11·6	"	"	"	"	C	
" ...	1935	"	" ..	Oct. 13..	21 19	20	0 45 W.	7·3	7·6	11·7	11·6	·0016	Fair......	P	
" ...	1936	"	" ..	" 13..	21 48	28	1 20 "	7·6	"	11·6	"	"	"	P	

P.—Plaskett.
H.—Harper.
C.—Cannon.
P1—Parker.

β ORIONIS.

RECORD OF SPECTROGRAMS—*Continued.*

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure G. M. T.	Duration.	Hour Angle at end.	Temperature Centigrade. Room. Begin-ning.	Room. End.	Prism Box. Begin-ning.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1908.	h. m.	m.	h. m.								
β Orionis...	1937	IIIL	Seed 27...	Oct. 13..	22 19	30	1 50 W.	7·6	7·6	11·6	11·6	·0016	Fair.....	P	
" ...	1938	"	" ..	" 13..	22 47	25	2 15 "	"	7·5	"	"	"	"	P	
" ...	1978	"	" ..	Nov. 21..	18 24	18	0 25 "	2·7	2·6	4·9	4·9	·0015	"	P	
" ...	1979	"	" ..	" 21..	18 43	17	0 45 "	2·6	1·5	"	"	"	....	P	
" ...	1980	"	" ..	" 21..	19 05	22	1 10 "	1·4	− 0·3	"	4·8	"	....	P	
" ...	1981	"	" ..	" 21..	19 33	30	1 40 "	− 0·3	− 1·5	4·8	"	"	....	P	Fog.
" ...	1984	"	" ..	" 28..	16 05	20	1 30 E.	5·2	5·0	6·7	6·7	·0016	....	P	
" ...	1985	"	" ..	" 28..	16 34	22	1 00 "	5·0	5·5	"	"	"	....	P	
" ...	1986	"	" ..	" 28..	17 08	15	0 10 "	5·5	"	"	"	"	....	P	
" ...	1987	"	" ..	Dec. 1..	17 53	27	0 35 W.	− 3·8	− 4·0	− 1·8	− 1·8	"	Good.....	P	
" ...	1988	"	" ..	" 1..	18 18	16	1 00 "	− 4·0	− 4·1	"	"	"	"	P	
" ...	1989	"	" ..	" 1..	18 36	16	1 18 "	− 4·1	− 4·2	"	"	"	"	P	
" ...	1990	"	" ..	" 1..	18 52	15	1 34 "	− 4·2	− 4·5	"	"	"	"	P	
" ...	2003	"	" ..	" 5..	16 10	10	1 00 E.	−16·0	−16·5	− 7·9	− 7·9	"	Fair.....	P	
" ...	2004	"	" ..	" 5..	16 22	10	0 48 "	....	....	....	....	·0016	"	P	
" ...	2005	"	" ..	" 5..	16 38	13	0 32 "	....	....	....	....	"	Poor.....	P	
" ...	2006	"	" ..	" 5..	16 53	13	0 15 "	....	−17·8	....	− 7·9	"	"	P	
" ...	2054	IL	" ..	" 21..	15 24	3	0 24 "	−11·2	−11·2	− 1·6	− 1·6	·0015	Good.....	P1	
" ...	2055	"	" ..	" 21..	15 29	2	0 20 "	"	"	"	"	"	"	P1	
" ...	2057	"	" ..	" 21..	16 54	2	0 45 W.	−12·4	−12·4	− 1·9	− 1·9	"	"	P1	
" ...	2058	"	" ..	" 21..	17 00	2	0 51 "	"	"	"	"	"	"	P1	
" ...	2065	IIIL	" ..	" 22..	17 38	10	1 20 "	−18·5	....	−13·0	....	·0016	"	P	
" ...	2066	"	" ..	" 22..	17 52	9	1 32 "	....	....	....	....	"	" ...	P	
" ...	2067	"	" ..	" 22..	18 02	8	1 43 "	....	....	....	....	"	"	P	
" ...	2068	"	" ..	" 22.	18 14	8	2 10 "	....	19·0	....	13·0	"	"	P	
" ...	2070	"	" ..	" 23..	14 01	14	1 55 E.	−14·5	−14·5	− 7·5	− 7·5	"	....	H	Drifting.
" ...	2071	"	" ..	" 23..	14 41	44	1 00 "	−16·0	−15·0	− 7·8	− 7·9	"	Poor.....	H. P.	
" ...	2072	"	" ..	" 23..	15 08	8	0 50 "	"	"	− 7·9	"	"	" ..	P	
" ...	2073	"	" ..	" 23..	15 19	8	0 40 "	"	"	"	"	"	....	P	
" ...	2075	"	" ..	" 26..	15 49	8	0 00 "	− 9·8	....	− 4·1	....	"	Steady...	P	

"	...	2076	"	"	"	26..	15	59	8	0	10	W.	....	....	− 4·2	....	"	....	P	
"	...	2077	"	"	"	26..	16	09	8	0	20	"	"	"	"	....	"	....	P	
"	...	2078	"	"	"	26..	16	19	8	0	30	"	....	....	....	....	"	....	P	
"	...	2079	"	"	"	27..	14	07	20	1	30	E.	0·0	....	0·0	....	"	Hazy	P	
"	...	2080	"	"	"	27..	15	12	15	0	20	"	0·5	....	0·1	....	"	Poor.	P	Only 5m. seeing.
"	...	2082	IL	"	"	31..	15	19	2	0	06	"	−10·0	−13·5	− 3·3	− 3·3	·0015	....	H	
"	...	2083	"	"	"	31..	15	23	2½	0	02	"	"	"	"	"	"	....	H	
"	...	2084	"	"	"	31..	15	29	3	0	02	W.	"	"	"	"	"	....	H	
"	...	2085	"	"	"	31..	15	57	5	0	31	"	"	"	"	"	"	....	H	
					1909.															
"	...	2092	"	"	Jan.	6..	16	49	2	1	36	W.	−16·5	....	− 2·8	....	·0015	Good.	H	
"	...	2093	"	"	"	6..	16	53	2	1	40	"	....	....	....	....	"	"	H	
"	...	2094	"	"	"	6..	17	13	2	2	00	"	....	....	....	....	"	"	H	
"	...	2095	"	"	"	6..	17	16	2	2	04	"	....	−17·5	....	− 3·1	"	"	H	
"	...	2105	"	"	"	7..	12	49	2	2	15	E.	−16·3	−16·3	− 9·2	− 9·2	"	Poor	P	
"	...	2106	"	"	"	7..	13	01	2	2	03	"	"	"	"	"	"	"	P	
"	...	2107	"	"	"	7..	13	04	2	2	00	"	....	....	....	....	"	"	P	
"	...	2108	"	"	"	7..	13	07	2	1	57	"	−16·4	−16·4	− 9·2	− 9·3	"	....	P	
"	...	2111	IIIL	"	"	7..	16	28	8	1	20	W.	−18·0	....	−13·3	....	·0016	Fair	P	
"	...	2112	"	"	"	7..	16	36	7	1	30	"	....	....	....	....	"	"	P	
"	...	2114	"	"	"	7..	16	56	8	1	55	"	....	−18·0	....	−13·3	"	....	P	
"	...	2117	IL	"	"	8..	15	48	2	1	00	"	−11·6	−11·6	− 8·9	− 8·9	·0015	Good	P^1	
"	...	2118	"	"	"	8..	15	52	2	1	04	"	−11·6	−11·6	"	"	·0015	"	P^1	
"	...	2122	"	"	"	12..	11	55	2	2	50	E.	− 9·0	−11·5	− 6·8	− 6·9	·0013	Poor	P	
"	...	2123	"	"	"	12..	11	59	2	2	46	"	....	....	....	....	"	....	P	
"	...	2124	"	"	"	12..	12	09	2	2	36	"	....	....	....	....	"	....	P	
"	...	2125	"	"	"	12..	12	12	2	2	33	"	....	....	....	....	"	....	P	
"	...	2126	"	"	"	12..	12	15	2	2	30	"	....	−11·5	....	− 6·9	"	....	P	
"	...	2127	"	"	"	12..	12	18	2	2	27	"	....	"	....	"	"	....	P	
"	...	2128	"	"	"	13..	15	36	2	0	55	W.	−15·0	−15·0	−12·0	−12·0	·0013	....	C	Focus as Jan. 12.
"	...	2129	"	"	"	13..	15	41	2	1	00	"	"	"	"	"	"	Good	H	
"	...	2130	"	"	"	13..	15	46	2	1	06	"	"	"	"	"	"	"	H	
"	...	2141	"	"	"	15..	14	54	2	0	19	"	−14·8	....	− 4·7	....	....	"	C	
"	...	2142	"	"	"	15..	15	11	2	0	36	"	....	....	....	....	....	"	C	
"	...	2143	"	"	"	15..	15	15	2	0	40	"	....	....	....	....	....	"	C	
"	...	2144	"	"	"	15..	15	19	2	0	47	"	....	−15·6	....	− 5·2	....	....	C	
"	...	2151	"	"	"	16..	12	25	10	2	00	E.	−21·5	−21·5	−12·0	−12·0	·0010	Very hazy	P	
"	...	2152	"	"	"	16..	12	36	7	1	49	"	....	....	....	....	"	Better.	P	
"	...	2153	"	"	"	16..	12	44	4	1	41	"	....	....	....	....	"	....	P	
"	...	2154	"	"	"	16..	12	52	5	1	33	"	....	....	....	....	"	....	P	
"	...	2155	"	"	"	16..	12	59	6	1	26	"	....	....	....	....	"	....	P	
"	...	2156	"	"	"	16..	13	12	16	1	10	"	....	−22·0	....	−12·0	"	....	P	
"	...	2157	"	"	"	17..	13	48	5	0	40	"	−13·5	....	−11·8	....	·0015	Good.	P^1	Focus unchanged.
"	...	2158	"	"	"	17..	13	56	7	0	30	"	....	−13·5	....	−11·8	"	"	P^1	
"	...	2161	"	"	"	18..	12	41	3	1	40	"	−17·5	....	−13·8	....	"	....	P	
"	...	2162	"	"	"	18..	12	46	3	1	35	"	....	....	....	....	"	....	P	
"	...	2163	"	"	"	18..	12	51	3	1	30	"	....	....	....	....	"	....	P	
"	...	2164	"	"	"	18..	13	04	2	1	17	"	....	....	....	....	"	....	P	

P.—Plaskett.
H.—Harper.
C.—Cannon.
P1—Parker.

β ORIONIS.

RECORD OF SPECTROGRAMS.—*Continued.*

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure. G. M. T.	Duration.	Hour Angle at End.	Temperature Centigrade. Room. Beginning.	Room. End.	Prism Box. Beginning.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1909.	h. m.	m.	h. m.								
β Orionis...	2165	IL	Seed 27..	Jan. 18..	13 10	2	1 11 E.					·0015		P	
" ...	2166	"	" ..	" 18..	13 14	2	1 08 "		−19·5		−13·8	"		P	
" ...	2177	"	" ..	" 26..	10 36	3	3 10 "	− 1·0		+ 1·8		·0013	Good.....	P	
" ...	2178	"	" ..	" 26..	10 51	2	2 55 "					"	" ...	P	
" ...	2179	"	" ..	" 26..	10 56	2	2 50 "					"	" ...	P	
" ...	2180	"	" ..	" 26..	11 01	3	2 45 "					"	" ...	P	
" ...	2181	"	" ..	" 26..	11 11	2	2 35 "					"	" ...	P	
" ...	2182	"	" ..	" 26..	11 16	3	2 30 "					"	" ...	P	
" ...	2183	"	" ..	" 26..	11 21	2	2 25 "		− 1·6		+ 1·8	"	" ...	P	
" ...	2184	"	" ..	" 28..	11 21	2	2 20 "	− 8·3		− 6·9		"	" ...	P	
" ...	2185	"	" ..	" 28..	11 25	2	2 16 "					"	" ...	P	
" ...	2186	"	" ..	" 28..	11 29	2	2 12 "					"	" ...	P	
" ...	2187	"	" ..	" 28..	11 41	2	2 00 "					"	" ...	P	
" ...	2188	"	" ..	" 28..	11 44	2	1 57 "					"	" ...	P	
" ...	2189	"	" ..	" 28..	11 47	2	1 55 "		− 9·0		− 6·9	"	" ...	P	
" ...	2195	"	" ..	" 29..	12 53	2	0 40 "	− 6·4		0·0		"		C	
" ..	2196	"	" ..	" 29..	12 57	3	0 38 "					"		C	
" ...	2197	"	" ..	" 29..	13 01	2	0 34 "					"		C	
" ...	2198	"	" ..	" 29..	13 05	3	0 30 "		− 6·4		0·0	"		C	
" ...	2201	"	" ..	" 30..	12 29	2	1 00 "					"	Fair....	P	
" ...	2202	"	" ..	" 30..	12 41	2	0 48 "					"	" ...	P	
" ...	2203	"	" ..	" 30..	12 45	2	0 45 "					"	" ...	P	
" ...	2204	"	" ..	" 30..	12 48	2	0 42 "		− 3·8		− 2·6	"	" ...	P	
" ...	2205	IIIL	" ..	" 30..	15 47	14	2 20 W.	− 6·0		− 2·7		·0016	Unsteady.	P	
" ...	2206	"	" ..	" 30..	16 04	16	2 37 "					"		P	
" ...	2207	"	" ..	" 30..	16 24	19	3 00 "		− 6·6		− 2·8	"		P	
" ...	2211	IL	" ..	. 31..	17 16	3	3 32 "	−19·0		− 6·0		·0013	Fair....	H	
" ...	2212	"	" ..	" 31..	17 20	3	3 36 "	−19·0		− 6·0		"	"	H	
" ...	2213	"	" ..	" 31..	17 24	5	3 40 "					"	"	H	
" ...	2214	"	" ..	" 31..	17 29	5	3 45 "		−19·0		− 6·0	"	"	H	

"	...	2215	"	"	Feb. 2..	11	14	2	2	05	E.	− 6·6	....	− 2·7	....	·0012	....	P	
"	...	2216	"	"	" 2..	11	23	2	1	56	"	....	....	....	....	"	....	P	
"	...	2217	"	"	" 2..	11	26	2	1	53	"	....	....	....	....	"	....	P	
"	...	2218	"	"	" 2..	11	29	2	1	50	"	....	....	....	....	"	....	P	
"	...	2219	"	"	" 2..	11	41	2	1	38	"	....	....	....	....	"	....	P	
"	...	2220	"	"	" 2..	11	45	2	1	35	"	....	− 7·1	....	− 2·8	"	....	P	
"	...	2236	"	"	" 6..	12	29	2		37	"	− 4·0	....	− 1·9	....	"	....	P	
"	...	2239	"	"	" 6..	12	50	1		16	"	....	....	....	....	"	....	P	
"	...	2240	"	"	" 6..	12	52	1		15	"	....	− 4·4	....	− 1·9	"	....	P	
"	...	2241	IIIL	"	" 6..	16	12	25	3	20	W.	− 3·8	− 3·5	− 3·0	− 3·0	·0016	....	P	Cloudy ⅔ time.
"	...	2242	"	"	" 6..	16	43	34	3	55	"	− 3·5	"	"	"	"	Poor	P	
"	...	2243	"	"	" 7..	15	11	13	2	15	"	− 2·5	− 3·5	− 1·2	− 1·2	"	Fair	P	
"	...	2244	"	"	" 7..	15	25	11	2	28	"	....	....	....	....	"	"	P	
"	...	2245	"	"	" 7..	15	37	10	2	39	"	....	....	....	....	"	"	P	
"	...	2249	IL	"	" 8..	13	32	2		38	"	−13·5	....	− 5·2	....	·0012	Good.....	P1	
"	...	2250	"	"	" 8..	13	36	2		42	"	....	....	....	....	"	"	P1	
"	...	2251	"	"	" 8..	13	41	2		47	"	....	....	....	....	"	"	P1	
"	...	2252	"	"	" 8..	14	01	2	1	07	"	....	....	....	....	"	"	P1	
"	...	2253	"	"	" 8..	14	05	2	1	11	"	....	....	....	....	"	"	P1	
"	...	2254	"	"	" 8..	14	09	2	1	15	"	....	−13·7	....	− 5·3	"	"	P1	
"	...	2265	"	"	" 10..	12	07	4		45	E.	− 4·0	....	− 1·8	....	·0011	Poor	H	Very windy.
"	...	2266	"	"	" 10..	12	12	3½		40	"	....	....	....	....	"	....	H	
"	...	2267	"	"	" 10..	12	16	2½		36	"	....	....	....	....	"	....	H	
"	...	2268	"	"	" 10..	12	21	2½		31	"	....	....	....	....	"	....	H	
"	...	2269	"	"	" 10..	12	33	2½		19	"	....	....	....	....	"	....	H	
"	...	2270	"	"	" 10..	12	37	2		10	"	....	− 4·0	....	− 1·8	"	....	H	
"	...	2272	"	"	" 11..	11	26	2	......	......		− 7·5	....	− 2·2	....	·0012	Good.....	P	
"	...	2273	"	"	" 11..	11	32	2	1	17	E.	....	....	....	....	"	"	P	
"	...	2274	"	"	" 11..	11	35	2	1	14	"	....	....	....	....	"	"	P	
"	...	2275	"	"	" 11..	11	38	2	1	11	"	....	....	....	....	"	"	P	
"	...	2276	"	"	" 11..	11	46	2	1	03	"	....	....	....	....	"	"	P	
"	...	2277	"	"	" 11..	11	49	2	1	00	"	....	....	....	....	"	"	P	
"	...	2278	IIIL	"	" 13..	12	27	10		05	"	− 4·5	....	+ 0·1	....	·0016	Fair	P	
"	...	2279	"	"	" 13..	12	40	10		08	W.	....	....	....	....	"	"	P	
"	...	2280	"	"	" 13..	12	53	10		21	"	....	− 5·0	....	0·0	"	"	P	
"	...	2284	"	"	" 20..	12	29	18		25	"	− 1·3	....	+ 3·8	....	·0015	....	P	
"	...	2285	"	"	" 20..	13	05	50	1	20	"	....	− 2·3	....	+ 3·6	"	Poor	P	Very cloudy.
"	...	2286	"	"	" 20..	15	12	15	3	10	"	....	− 3·4	....	+ 3·3	"	Fair	P	
"	...	2288	"	"	" 21..	12	57	9		55	"	− 1·6	....	+ 4·3	....	"	Good.....	P	
"	...	2289	"	"	" 21..	13	07	9	1	05	"	....	....	....	....	"	"	P	
"	...	2290	"	"	" 21..	13	17	9	1	15	"	....	....	....	....	"	"	P	
"	...	2291	"	"	" 21..	13	28	9	1	25	"	....	− 2·4	....	+ 4·2	"	"	P	
"	...	2292	"	"	" 22..	12	02	10		10	"	− 0·8	− 1·0	3·0	3·0	"	"	P1	
"	...	2293	"	"	" 22..	12	15	10		20	"	− 1·0	"	"	2·9	"	"	P1	
"	...	2294	"	"	" 22..	12	30	10		35	"	"	"	"	"	"	"	P1	
"	...	2295	"	"	" 22..	12	42	9		47	"	"	"	"	"	"	"	P1	
"	...	2309	"	"	" 27..	11	32	25		03	"	1·5	1·2	5·0	5·0	"	Hazy.....	P	
"	...	2311	"	"	" 28..	11	56	8		20	"	− 6·8	....	− 1·2	....	"	Good.....	P	
"	...	2312	"	"	" 28..	12	07	10		30	"	....	....	....	....	"	"	P	
"	...	2313	"	"	" 28..	12	18	7		41	"	....	....	....	....	"	"	P	

P.—Plaskett.
H.—Harper.
C.—Cannon.
P¹—Parker.

β ORIONIS.

RECORD OF SPECTROGRAMS.—*Continued.*

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure. G. M. T.	Duration.	Hour Angle at End.	Temperature Centigrade. Room. Beginning.	Room. End.	Prism Box. Beginning.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1909.	h. m.	m.	h. m.								
β Orionis	2314	IIIL	Seed 27	Feb. 28	12 27	7	50 W.					·0015	Good	P	
"	2315	"	"	" 28	12 39	12	1 02 "					"	"	P	
"	2316	"	"	" 28	12 50	8	1 15 "		− 8·4		− 1·3	"	"	P	
"	2317	"	"	Mar. 2	11 05	10	22 E.	0·3		3·6		·0016	"	P	
"	2318	"	"	" 2	11 19	8	8 "					"	"	P	
"	2319	"	"	" 2	11 29	8	2 W.					"	"	P	
"	2320	"	"	" 2	11 39	8	10 "	1·0		3·6		"	"	P	
"	2364	"	"	" 13	12 12	8	1 28 "	2·8		7·2		·0015	"	P	
"	2365	"	"	" 13	12 24	8	1 40 "					"	"	P	
"	2366	"	"	" 13	12 36	8	1 52 "					"	"	P	
"	2367	"	"	" 13	12 46	7	2 02 "					"	"	P	
"	2368	"	"	" 13	12 57	6	2 10 "		2·1		7·0	"	"	P	
"	2372	"	"	" 15	11 45	10	1 10 "	−0·4		2·0		"	"	P	
"	2373	"	"	" 15	11 56	7	1 21 "					"	"	P	
"	2374	"	"	" 15	12 05	6	1 30 "					"	"	P	
"	2375	"	"	" 15	12 13	6	1 35 "					"	"	P	
"	2376	"	"	" 15	12 21	6	1 40 "		−1·2		+1·9	"	"	P	
"	2386	"	"	" 18	11 42	9	1 20 "	−0·4		3·8		"		P	
"	2387	"	"	" 18	11 52	7	1 30 "					"		P	
"	2388	"	"	" 18	12 02	8	1 40 "					"		P	
"	2389	"	"	" 18	12 12	7	1 50 "		0·5		3·7	"		P	
"	2390	"	"	" 20	12 16	7	1 00 "	11·0		7·2		"	Fair	P	
"	2391	"	"	" 20	12 26	7	1 10 "					"	"	P	
"	2392	"	"	" 20	12 38	10	1 22 "					"	"	P	
"	2393	"	"	" 20	12 48	7	1 30 "					"	"	P	
"	2394	"	"	" 20	12 58	7	1 40 "		0·5		7·0	"	"	P	
"	2397	"	"	" 21	13 38	8	3 25 "	−1·8		4·0		"	"	P	
"	2398	"	"	" 21	13 48	9	3 35 "					"	"	P	
"	2399	"	"	" 21	14 00	11	3 47 "					"	"	P	
[illegible]	2400			21	14 14	12	4 02 "		−3·8		3·9	"	"	P	

"	...	2402	"	" ..	" 22..	11 51	10	1 31	"	3·1	....	4·8	....	"	Good.....	P
"	...	2403	"	" ..	" 22..	12 02	10	1 42	"	....	....	....	....	"	"	P
"	...	2404	"	" ..	" 22..	12 13	11	1 51	"	....	....	....	....	"	"	P
"	...	2405	"	" ..	" 22..	12 35	9	2 15	"	....	2·6	....	4·8	"	"	P
"	...	2420	"	" ..	" 23..	11 46	6	1 40	"	5·4	....	8·1	....	"	"	P
"	...	2421	"	" ..	" 23..	11 57	6	1 51	"	....	....	....	....	"	"	P
"	...	2422	"	" ..	" 23..	12 05	6	1 59	"	....	....	....	....	"	"	P
"	...	2423	"	" ..	" 23..	12 13	7	2 07	"	....	....	....	....	"	"	P
"	...	2424	"	" ..	" 23..	12 27	8	2 20	"	....	....	....	....	"	"	C
"	...	2425	"	" ..	" 23..	12 38	8	2 33	"	....	3·5	....	6·8	"	"	C

β ORIONIS 1241 *a*.

1908. Jan. 20.
G. M. T. $15^h\ 00^m$

Observed by, Measured by: J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·0256	....	....	....	1½	53·1058	....	....	....
3	53·0008	·0048	·0350	+40·28	3	45·2624	·2724	·0337	+35·17
2	53·4440	·4490	·0467	53·40	2	45·2628	....	....	....

Weighted mean		+41·64
V_a	−17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+ 23·3

β ORIONIS 1241 *b*.

1908. Jan. 20.
G. M. T. $15^h\ 00^m$

Observed by, Measured by: J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7354	....	....	....	2	53·1094	....	....	....
2	54·0270	....	....	....	3	45·2712	·2755	·0368	+38·41
3	54·0008	·0048	·0350	+40·28	2	45·2684	....	....	....
1	53·4328	·4360	·0337	+38·54					

Weighted mean		+39·23
V_a	−17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+ 20·9

β ORIONIS 1241 *c*.

1908. Jan. 20.
G. M. T. $15^h\ 00^m$

Measured by, Observed by: J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
	54·7640	....	....	....		53·1358	....	....	....
	54·0552	....	....	....		45·2960	....	....	....
2	54·0360	·0130	·0448	+51·56	3	45·2952	·2727	·0340	+35·49
1	53·4715	·4485	·0462	+52·83					

Weighted mean		+43·74
V_a	−17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+ 25·4

β ORIONIS 1247 *a*.

1908. Jan. 20.
G. M. T. 15h 15m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7385	....	....	....	2	53·1054	....	....	....
2	54·0270	....	....	....	2	45·2652	·2737	·0350	+36·53
3	54·0012	·0052	·0354	+40·74	2	45·2653	....	....	....
3	53·4384	·4434	·0411	+47·00					

Weighted mean		+42·03
V_a	−17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+ 23·7

β ORIONIS 1242 *b*.

1908. Jan. 20.
G. M. T. 15h 15m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7430	....	....	....	2	53·1110	....	....	....
1	54·0320	....	....	....	3	45·2740	·2783	·0396	+41·34
2½	54·0078	·0078	·0380	+43·76	2	45·2692	....	....	....
1½	53·4467	·4467	·0444	50·75					

Weighted mean		+44·22
V_a	−17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+25·9

β ORIONIS 1242 *c*.

1908. Jan. 20.
G. M. T. 15h 15m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7111	....	....	....	2	53·0790	....	....	....
1	54·0022	....	....	....	2	45·2307	·2655	·0268	+27·97
3	53·9678	·9990	·0292	+33·61	2	45·2378	....	....	....
2	53·4174	·4500	·0477	+54·55					

Weighted mean		+37·98
V_a		−17·93
V_d		− ·09
Curvature	− ·28	
Radial velocity		+19·7

β ORIONIS 1243 *a*.

1908. Jan. 20.
G. M. T. 15h 27m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.
2	54·7409	....	....	....	2	53·1154	....	....	....
2	54·0332	....	....	....	3	45·2837	·2760	·0373	+38·93
3	54·0104	·0064	·0366	+42·12	.....	45·2814	....	....	....
2	53·4376	·4346	·0323	36·94					

Weighted mean....................		+39·63
V_a....................	−17·93	
V_d....................	− ·09	
Curvature....................	− ·28	
Radial velocity....................		+21·3

β ORIONIS 1243 *b*.

1908. Jan. 20.
G. M. T. 15h 27m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.
2	54·7300	....	....	....	2	53·1011	....	....	....
2	54·0188	....	....	....	3	45·2702	·2730	·0343	+35·80
2	53·9988	·0098	·0400	+46·04	......	45·2712	....	....	....
2	53·4319	·4429	·0406	46·43					

Weighted mean....................		+41·76
V_a....................	−17·93	
V_d....................	− ·09	
Curvature....................	− ·28	
Radial velocity....................		+23·5

β ORIONIS 1243 *c*.

1908. Jan. 20.
G. M. T. 15h 27m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity
2	54·7244	....	....	....	2	53·0980	....	....	....
2	54·0125	....	....	....	3	45·2705	·2820	·0433	+45·1[illegible]
2	53·9841	·0000	·0302	+34·76	.....	45·2622	....	....	....
2	53·4295	·4445	·0422	48·26					

Weighted mean....................		+43·09
V_a....................	−17·93	
V_d....................	− ·09	
Curvature....................	− ·28	
Radial velocity....................		+24·8

β ORIONIS 1244 *a*.

1908. Jan. 20.
G. M. T. 15h 47m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7275	....	....	....	2	53·0998	....	....	....
2	54·0201	....	....	....	3	45·2686	·2811	·0424	+44·25
3	53·9956	·0056	·0358	+41·20	2	45·2611	....	....	....
2	53·4305	·4410	·0387	43·11					

Weighted mean..................		+42·82
V_a..............	−17·93	
V_d..............	− ·09	
Curvature..........	− ·28	
Radial velocity..................		+24·5

β ORIONIS 1244 *b*.

1908. Jan. 20.
G. M. T. 15h 47m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7310	....	....	....	2	53·1050	....	....	....
2	54·0209	....	....	....	3	45·2620	·2723	·0336	+35·07
3	53·9910	·9990	·0292	+33·61	2	45·2632	....	....	....
2	53·1264	·4340	·0317	36·25					

Weighted mean..................		+34·82
V_a..............	−17·93	
V_d..............	− ·09	
Curvature..........	− ·28	
Radial velocity..................		+16·5

β ORIONIS 1244 *c*.

1908. Jan. 20.
G. M. T. 15h 47m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7336	....	....	....	2	53·1058	....	....	....
2	54·0231	....	....	....	3	45·2684	·2780	·0393	+41·02
3	54·0019	·0090	·0392	+45·11	2	45·2638	....	....	....
2	53·4395	·4460	·0437	49·97					

Weighted mean..................		+44·75
V_a..............	−17·93	
V_d..............	− ·09	
Curvature..........	− ·28	
Radial velocity..................		+26·4

β ORIONIS 1245 a.

1908. Jan. 20.
G. M. T. 15h 53m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7272	....	....	....	2	53·1018	....	....	....
1	54·0156	....	....	....	3	45·2650	·2763	·0376	+39·24
3	53·9966	·0090	·0392	+45·12	2	45·2622	....	....	....
2	53·4315	·4430	·0407	46·54					

Weighted mean		+43·27
V_a	−17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+ 25.0

β ORIONIS 1245 b.

1908. Jan. 20.
G. M. T. 15h 53m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7467	....	....	....	2	53·1202	....	....	....
2	54·0342	....	....	....	3	45·2774	·2750	·0363	+37·89
3	54·0134	·0074	·0376	+43·27	2	45·2760	....	....	....
2	53·4430	·4340	·0337	38·53					

Weighted mean		+40·07
V_a	−17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+ 21.8

β ORIONIS 1245 c.

1908. Jan. 20.
G. M. T. 15h 53m

Observed by } J. S PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7458	....	....	....	2	53·1193	....	....	....
2	54·0321	....	....	....	3	45·2750	·2740	·0353	+36·84
3	54·0084	·0034	·0336	+38·67	2	45·2742	....	....	....
2	53·4436	·4390	·0367	41·97					

Weighted mean		+38·81
V_a	−17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+ 20·5

β ORIONIS 1249 *a*.

1908. Jan. 20.
G. M. T. $16^h\ 37^m$

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7444	....	....	....	2	53·1200	....	....	....
2	54·0334	....	....	....	3	45·2714	·2663	·0291	+30·37
3	54·0037	·9987	·0289	+33·26	2	45·2782	....	....	....
2	53·4376	·4320	·0297	33·96					

Weighted mean....................		+32·35
V_a..............	−17·93	
V_d..............	− ·09	
Curvature........	− ·28	
Radial velocity....................		+14·0

β ORIONIS 1247 *a*.

1908. Jan. 20.
G. M. T. $16^h\ 17^m$

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7364	....	....	....	2	53·1070	....	....	....
1	54·0227	....	....	....	2	45·2606	·2715	·0327	+34·13
3	54·0078	·0138	·0440	+50·64	2	45·2624	....	....	....
2	53·4296	·4350	·0327	37·40					

Weighted mean....................		+42·14
V_a..............	−17·93	
V_d..............	− ·09	
Curvature.....	− ·28	
Radial velocity....................		+23·8

β ORIONIS 1247 *b*.

1908. Jan. 20.
G. M. T. $16^h\ 17^m$

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity
2	54·7274	....	....	....	2	53·0931	....	....	....
1	54·0096	....	....	....	3	45·2634	·2794	·0397	+41·43
3	53·9963	·0135	·0437	+50·29	2	45·2577	....	....	....
2	53·4377	·4557	·0534	61·06					

Weighted mean....................		+49·66
V_a..............	−17·93	
V_d..............	− ·09	
Curvature.......	− ·28	
Radial velocity....................		+31·3

β ORIONIS 1247 *c*.

1908. Jan. 20.
G. M. T. 16h 17m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7281	....	....	....	2	53·0985	....	....	....
1	54·0124	....	....	....	3	45·2528	·2692	·0305	+31·83
3	53·9902	·0048	·0350	+40·28	2	45·2570	....	....	....
2	53·4238	·4386	·0363	41·51					

Weighted mean .... +37·42
V_a .... −17·93
V_d .... − ·09
Curvature .... − ·28

Radial velocity .... +19·0

β ORIONIS 1248 *a*.

1908. Jan. 20
G. M. T. 16h 27m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7473	....	....	....	2	53·1167	....	....	....
1	54·0314	....	....	....	2	45·2794	....	....	....
2	53·9942	·9900	·0211	+24·28	3	45·2792	·2735	·0348	+36·32
1	53·4267	·4220	·0197	22·53					

Weighted mean .... +30·01
V_a .... −17·93
V_d .... − ·09
Curvature .... − ·28

Radial velocity .... +11·6

β ORIONIS 1248 *b*.

1908. Jan. 20.
G. M. T. 16h 27m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7402	....	....	....	2	53·1140	....	....	....
1	54·0234	....	....	....	3	45·2624	·2660	·0273	+28·49
1	53·9742	·9760	·0071	+ 8·17	2	45·2770	....	....	....
1	53·4253	·4260	·0237	27·10					

Weighted mean .... +24·15
V_a .... −17·93
V_d .... − ·09
Curvature .... − ·28

Radial velocity .... + 5·8

β ORIONIS 1248 *c*.

1908. Jan. 20.
G. M. T. 16^{h} 27^{m}

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.
2	54·7472	....	....	....	2	53·1250	....	....	....
1	54·0420	....	....	....	3	45·2991	·2891	·0504	+52·60
2	54·0294	·0174	·0505	+58·12	2	45·2836	....	....	....
2	53·4593	·4493	·0470	53·75					

Weighted mean..................		+54·51
V_a..................	−17·93	
V_d..................	− ·09	
Curvature..................	− ·28	
Radial velocity..................		+36·1

β ORIONIS 1249 *b*.

1908. Jan. 20.
G. M. T. 16^{h} 37^{m}

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.
2	54·7478	....	....	....	2	53·1232	....	....	....
2	54·0356	....	....	....	3	45·2788	·2680	·0293	+30·58
2	54·0084	·0004	·0306	+35·22	—	45·2844	....	....	....
2	53·4450	·4365	·0342	39·11					

Weighted mean..................		+34·34
V_a..................	−17·93	
V_d..................	− ·09	
Curvature..................	− ·28	
Radial velocity..................		+16·0

β ORIONIS 1249 *c*.

1908. Jan. 20.
G. M. T. 16^{h} 37^{m}

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.
2	54·7362	....	....	....	2	53·1092	....	....	....
2	54·0240	....	....	....	3	45·2725	·2760	·0373	+38·93
2	53·9998	·0040	·0342	+39·36	—	45·2704	....	....	....
2	53·4435	·4473	·0451	51·57					

Weighted mean..................		+42·66
V_a..................	−17·93	
V_d..................	− ·09	
Curvature..................	− ·28	
Radial velocity..................		+24·2

β ORIONIS 1285 *a*.

1908. Jan. 27.
G. M. T. 15h 30m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns.	Velocity.
2	56·2642	....	....	....	2	54·8480	....	....	....
2	56·2207	·2768	·0470	+35·17	1½	42·3191	·3130	·0520	+32·61
1½	55·3517	·4083	·0539	39·88	2	42·3130	....	....	....

Weighted mean................ +35·81
V_a .... −20·08
V_d .... − ·16
Curvature .... − ·30

Radial velocity.................. +15·3

β ORIONIS 1285 *b*.

1908. Jan. 27.
G. M. T. 15h 30m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3371	....	....	....	2	54·8307	....	....	....
2	56·2462	....	....	....	2	42·3000	·3283	·0673	+42·20
2	56·1983	·2724	·0426	+31·88	1½	42 3092	....	....	....
1	55·3500	·4241	·0697	51·53					

Weighted mean................ +39·72
V_a .... −20·08
V_d .... − ·16
Curvature.......... − ·30

Radial velocity................. +19·2

β ORIONIS 1285 *c*.

1908. Jan. 27.
G. M. T. 15h 30m.

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3127	....	....	....	2	54·8130	....	....	....
2	56·2255	....	....	....	2	42·2834	....	....	....
2	56·1773	·2718	·0420	+31·43	1½	42·2936	·3293	·0683	+42·83
2	55·3222	·4147	·0603	44·62					

Weighted mean............... +39·38
V_a .... −20·08
V_d .... − ·16
Curvature.......... − ·30

Radial velocity............... +17·9

β ORIONIS 1286 *a*.

1908. Jan. 27.
G. M. T. 16h 09m.

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·2727	....	....	....	2	54·7770	....	....	....
2	56·1937	....	....	....	2	42·2466	....	....	....
2	56·1589	·2869	·0571	+42·73	1½	42·2512	·3227	·0617	+38·6
2	55·2850	·4130	·0586	43·36					

Weighted mean		+42·20
V_a	−20·08	
V_d	− ·19	
Curvature	− ·30	
Radial velocity		+21·3

β ORIONIS 1286 *b*

1908. Jan. 27.
G. M. T. 16h 09m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3533	....	....	....	2	54·8539	....	....	....
2	56·2652	....	....	....	2	42·3240	....	....	....
2	56·2297	·2848	·0550	+41·16	1½	42·3241	·3192	·0582	+36·50
1½	55·3552	·4074	·0530	39·21					

Weighted mean		+39·17
V_a	−20·08	
V_d	− ·20	
Curvature	− ·28	
Radial velocity		+18·7

β ORIONIS 1286 *c*.

1908. Jan. 27.
G. M. T. 16h 09m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3761	....	....	....	2	54·8777	....	....	....
2	56·2915	....	....	....	2	42·3443	....	....	....
2	56·2610	·2898	·0600	+44·90	2	42·3548	·3296	·0686	+43·02
2	55·3896	·4175	·0631	46·68					

Weighted mean		+44·87
V_a	−20·08	
V_d	− ·19	
Curvature	− ·30	
Radial velocity		+24·3

β ORIONIS 1289 *a*.

1908. Jan. 27.
G. M. T. 17^h 17^m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	57·3477	....	....	....	2	54·8500	....	....	....
2	56·2633	....	....	....	3	42·3258	·3168	0558	+34·99
2	56·2241	·1671	·0627	+46·92	2	42·3286	....	....	....
1½	55·3630	·3070	·0474	35·07					

Weighted mean........................		+38·62
V_a	−20·08	
V_d	− ·19	
Curvature	− ·30	
Radial velocity...............		+18·1

β ORIONIS 1289 *b*.

1908. Jan. 27.
G. M. T. 17^h 17^m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	57·3801	....	....	....	2	54·8794	....	....	....
1	56·2921	....	....	....	3	42·3664	·3275	·0665	+41·70
3	56·2507	·2780	·0482	+36·07	2	42·3584	....	....	....
2	55·3890	·4155	·0611	45·21					

Weighted mean........................		+40·46
V_a	−20·08	
V_d	− ·19	
Curvature	− ·30	
Radial velocity.....................		+19·9

β ORIONIS 1289 *c*.

1908. Jan. 27.
G. M. T. 17^h 17^m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	57·3608	....	....	....	2	54·8612	....	....	....
2	56·2675	....	....	....	3	42·3602	·3425	·0815	+51·11
3	56·2378	·2900	·0602	+45·05	2	42·3378	....	....	....
2	55·3721	·4200	·0656	48·54					

Weighted mean........................		+ 48·19
V_a	− 20·08	
V_d	− ·19	
Curvature........	− ·30	
Radial velocity.....................		+ 27·8

β ORIONIS 1290 *a*.

1908. Jan. 27.
G. M. T. 17h 28m

Observed by / Measured by } J. S. Plaskett

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3519	....	....	....	2	54·8582	....	....	....
2	56·2658	....	....	....	2	42·3268	·3156	·0546	+34·24
3	56·2260	·2800	·0502	+37·56	2	42 3308	....	....	....

Weighted mean		+ 36·23
V_a	− 20·08	
V_d	− ·19	
Curvature	− ·30	
Radial velocity		+ 15·6

β ORIONIS 1290 *b*.

1908. Jan. 27.
G. M. T. 17h 28m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3527	....	....	....	2	54·8536	....	....	....
2	56·2622	....	....	....	2	42·3223	·3190	·0580	+36·37
3	56·2360	·2940	·0642	+48·04	2	42·3224	....	....	....
2	55·3534	·4074	·0530	39·21					

Weighted mean		+ 42·18
V_a	− 20·08	
V_d	− ·19	
Curvature	− ·30	
Radial velocity		+ 21·6

β ORIONIS 1290 *c*.

1908. Jan. 27.
G. M. T. 17h 28m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3596	....	....	....	2	54·8680	....	....	....
2	56·2706	....	....	....	3	42·3490	·3313	·0503	+31·54
3	56 2320	·2810	·0512	+38·31	2	42·3368	....	....	....
1½	55·3704	·4134	·0590	43·65					

Weighted mean		+ 36·70
V_a	− 20·08	
V_d	− ·19	
Curvature	− ·30	
Radial velocity		+ 16·1

β ORIONIS 1405.

1908. Mar. 20.
G. M. T. 11h 51m

Observed by } Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3300	....	....	....	2	58·7869	....	....	....
2	61·3502	....	....	....	2	36·2090	·2170	·1265	+44·48
2	61·3121	·3064	·1259	+52·05	2	36·1858	....	....	....
1½	59·7292	·7236	·1271	52·00					

Weighted mean........................ +48·37
V_a.................. −24·86
V_d.................. − ·14
Curvature.............. − ·28

Radial velocity........................ +23·1

β ORIONIS 1406.

1908. Mar. 20.
G. M. T. 12h 07m

Observed by } Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3238	....	....	....	2	58·7846	....	....	....
2	61·3466	....	....	....	1½	36·2180	·2235	·1330	+46·76
2	61·3115	·3095	·1290	+53·33	2	36·1886	....	....	....
1½	59·7150	·7122	·1157	47·33					

Weighted mean........................ +49·56
V_a.................. −24·86
V_d.................. − ·14
Curvature.............. − ·28

Radial velocity........................ + 24·3

β ORIONIS 1407.

1908. Mar. 20.
G. M. T. 12h 21m

Observed by } Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3248	....	....	....	2	58·7785	....	....	....
2	61·3441	....	....	....	2	36·1872	·2090	·1185	+41·66
3	61·2936	·2941	·1136	+46·96	2	36·1721	....	....	....
1½	59·7240	·7260	·1295	52·98					

Weighted mean........................ +46·72
V_a.................. −24·86
V_d.................. − ·14
Curvature.............. − ·28

Radial velocity........................ +21·4

β ORIONIS 1408.

1908. Mar. 20.
G. M. T. 12ʰ 32ᵐ

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	63·3338	....	....	....	2	58·7904	....	....	....
2	61·3533	....	....	....	2	36·2218	·2315	·1410	+49·58
2	61·3036	·2946	·1141	+47·17	1½	36·1832	....	....	....
1½	59·7392	·7302	·1337	54·70					

Weighted mean............................		+50·15
V_a....................	−24·86	
V_d....................	− ·14	
Curvature............	− ·28	
Radial velocity............................		+ 24·9

β ORIONIS 1409.

1908. Mar. 20.
G. M. T. 12ʰ 46ᵐ

Observed by / Measured by } J. S. PLASKETT.

Wt	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	63·3224	....	....	....	1	58·7782	....	....	....
2	61·3452	....	....	....	2	36·2226	·2365	·1460	+51·33
2	61·3028	·3048	·1243	+51·39	2	36·1801	....	....	....
1½	59·7364	·7390	·1425	58·30					

Weighted mean............................		+53·25
V_a....................	−24·86	
V_d....................	− ·14	
Curvature............	− ·28	
Radial velocity............................		+28·0

β ORIONIS 1410.

1908. Mar. 20.
G. M. T. 13ʰ 00ᵐ

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	63·3280	....	....	....	2	58·7856	....	....	....
2	61·3492	....	....	....	2	36·2229	·2265	·1360	+47·82
2	61·3050	·3010	·1205	+49·81	2	36·1906	....	....	....
1½	59·7178	·7136	·1171	47·91					

Weighted mean............................		+48·57
V_a....................	−24·86	
V_d....................	− ·14	
Curvature............	− ·28	
Radial velocity............................		+23·3

β ORIONIS 1411.

1908. March 20.
G. M. T. 13^h 12^m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	$Disp^t$ in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	$Disp^t$ in rev^{ns}	Velocity.
2	63·1088	....	....	....	2	58·5647	....	....	....
3	61·0842	61·2989	+ ·1184	+48·95	2	35·9590	....	....	....
1½	59·5095	59·7259	·1294	52·94	2	0·9851	36·2203	·1298	+45·64

Weighted mean .... +48·85
V_a .... −24·86
V_d .... − ·17
Curvature .... − ·28

Radial velocity .... +23·5

β ORIONIS 1412.

1908. March 20.
G. M. T. 13^h 27^m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	$Disp^t$ in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	$Disp^t$ in rev^{ns}	Velocity.
2	63·1178	....	....	....	2	58·5736	....	....	....
3	61·0974	61·3005	·1200	+49·60	2	35·9727	....	....	....
2	59·5242	59·7314	·1349	55·18	2	36·0000	36·2215	·1310	+46·06

Weighted mean .... +50·18
V_a .... -24·86
V_d .... − ·17
Curvature .... − ·28

Radial velocity .... +24·9

β ORIONIS 1413.

1908. March 20.
G. M. T. 13^h 47^m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	$Disp^t$ in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	$Disp^t$ in Rev^{ns}	Velocity.
2	63·3873	....	....	....	2	58·8412	....	....	....
3	61·3699	61·3083	·1278	+52·83	2	36·3010	36·2455	·1550	+54·50
1½	59·7810	59·7205	·1240	50·73	2	36·2495	....	....	....

Weighted mean .... +52·86
V_a .... −24·86
V_d .... − ·17
Curvature .... − ·28

Radial velocity .... +27·5

β ORIONIS 1414.

1908. March 20.
G. M. T. 13h 57m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3927	... .	....	....	2	58·8485	....	....	....
3	61·3695	61·3015	·1210	+50·02	2	36·2981	36·2350	·1445	+54·40
2	59·7945	59·7270	·1350	53·38	2	36·2572	....	... ...	....

Weighted mean		+52·23
V_a	−24·86	
V_d	− ·17	
Curvature	− ·28	
Radial velocity		+26·9

β ORIONIS 1426.

1908. March 24.
G. M. T. 12h 03m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3455	....	....	....	2	58·7935	..... .	....	....
2	61·2946	61·2780	·0975	+40·35	1½	36·1955	36·2300	·1395	+49·05
1½	59·7192	59·7040	·1075	43·98	2	36·1592	... .	....	....

Weighted mean		+44·05
V_a	−24·36	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+19·2

β ORIONIS 1427.

1908. March 24.
G. M. T. 12h 15m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3382	....	....	....	2	58·7912	..... .	....	....
2	61·2918	61·2798	·0993	+41·09	2	36·2085	36·2340	·1435	+50·45
1	59·7208	59·7098	·1133	46·35	2	36·1682	....	....	....

Weighted mean		+45·89
V_a	−24·36	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+21·1

β ORIONIS 1428.

1908. March 24.
G. M. T. 12h 23m

Observed by } Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3148	....	....	....	2	58·7726	....	....	....
2	61·2682	61·2772	·0967	+40·01	2	36·1838	36·2255	·1350	+47·47
1½	59·6971	59·7060	·1095	44·80	2	36·1522	....	....	....

Weighted mean.................... +44·03
V_a .... −24·36
V_d .... − ·16
Curvature........ − ·28

Radial velocity.................. +19·2

β ORIONIS 1429.

1908. March 24.
G. M. T. 12h 36m

Observed by } Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3133	....	....	....	2	58·7619	....	....	....
2	61·2675	61·2825	·1020	+42·21	2	36·1559	36·2215	·1310	+46·06
1½	59·6988	59·7160	·1195	48·89	2	36·1282	....	....	....

Weighted mean.................... +45·43
V_a .... −24·36
V_d .... − ·16
Curvature........ − ·28

Radial velocity.................. +21·6

β ORIONIS 1430.

1908. March 24.
G. M. T. 12h 42m

Observed by } Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3288	....	....	....	2	58·7792	....	....	....
2	61·2808	61·2795	·0995	+41·17	1½	36·1830	36·2190	·1285	+45·18
1½	59·7068	59·7075	·1110	45·41	2	36·1581	....	....	....

Weighted mean.................... +43·65
V_a .... −24·36
V_d .... − ·16
Curvature........ − ·28

Radial velocity.................. +18·8

β ORIONIS 1431.

1908. March 24.
G. M. T. 12h 52m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3248	....	....	....	2	58·7802	....	....	....
2	61·2775	61·2775	·0970	+40·14	2	36·1932	36·2350	·1445	+50·81
1½	59·6884	59·6890	·0925	+37·84	2	36·1520	....	....	....

Weighted mean		+43·39
V_a	−24·36	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+18·6

β ORIONIS 1433.

1908. March 24.
G. M. T. 13h 16m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3394	....	....	....	2	58·7740	....	....	....
2	61·2791	61·2816	·1011	+41·84	2	36·1666	36·2106	·1201	+42·23
1½	59·6956	59·7020	·1055	43·16	2	36·1490	....	....	....

Weighted mean		+ 42·34
V_a	− 24·36	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+ 17·5

β ORIONIS 1434.

1908. March 24.
G. M. T. 13h 32m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3430	....	....	....	2	58·7969	....	....	....
2	61·2968	61·2790	·0985	+40·76	1	36·2018	36·2210	·1305	+45·88
1	59·7385	59·7215	1254	51·30	2	36·1742	....	....	....

Weighted mean		+ 44·08
V_a	− 24·36	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+ 19·3

β ORIONIS 1435.

1908. March 24.
G. M. T. 13ʰ 39ᵐ

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	63·3082	....	....	....	2	58·7515	....	....	....
2	61·2508	61·2727	·0922	+38·15	1½	36·1366	36·2126	·1221	+42·93
1	59·6764	59·7034	·1069	43·32	2	36·1180	....	....	....

Weighted mean		+40·89
V_a	− 24·36	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+16·1

β ORIONIS 1436.

1908. March 24.
G. M. T. 13ʰ 48ᵐ

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	63·3496	....	....	....	2	58·8030	....	....	....
2	61·2902	61·2762	·0957	+39·60	1½	36·2066	36·2310	·1405	+49·40
1½	59·7106	59·6876	·0921	37·68	2	36·1692	....	....	....

Weighted mean		+41·96
V_a	− 24·36	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+17·2

β ORIONIS 1437.

1908. March 24
G. M. T. 13ʰ 5·6ᵐ

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	63·3020	....	....	....	2	58·7548	....	....	....
1½	61·2558	61·2800	·0995	+41·17	2	36·1466	36·2180	·1275	+44·83
1	59·6798	59·7050	·1085	44·39	2	36·1222	....	....	....

Weighted mean		+43·51
V_a	− 24·36	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+18·7

β ORIONIS 1438.

1908. March 24.
G. M. T. 14h 07m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3504	... .	....	....	2	58·8022	....	....	....
1½	61·3018	61·2780	·0975	+40·54	1½	36·2016	36·2170	·1265	+44·48
1	59·7345	59·7125	·1160	47·46	2	36·1784	....	....	....

Weighted mean........................... +43·75
V_a.......................... − 24·36
V_d.......................... − ·16
Curvature...................... − ·28

Radial velocity.......................... + 18·0

β ORIONIS 1439.

1908. March 30.
G. M. T. 12h 19m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3002	... .	... .	....	2	58·7534	... .. .	....	....
3	61·2444	·2993	·0870	+35·86	2	36·1192	·1568	·1087	+38·11
1½	59·6804	·7304	·1066	43·48	2	36·1146	....	....	....

Weighted mean........................... +38·31
V_a.......................... − 23·39
V_d.......................... − ·21
Curvature...................... − ·28

Radial velocity.......................... +14·4

β ORIONIS 1440.

1908. March 30.
G. M. T. 12h 29m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3356	....	....	....	2	58·7895	....	....	....
2	61·2894	·3087	·0964	+39·74	2	36·1602	·1480	0999	+35·02
1½	59·6994	·7132	·0894	40·54	2	36·1642	....	.. ..	. ...

Weighted mean........................... +38·24
V_a.......................... − 23·39
V_d.......................... − ·21
Curvature...................... − ·28

Radial velocity.......................... +14·4

β ORIONIS 1441.

1908. Mar. 30.
G. M. T. 12h 38m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·4150	......	......	......	2	58·8640	......	......	......
2	61·3622	·3042	·0919	+37·88	1½	36·2522	·1620	·1139	+39·93
1	59·7768	·7148	·0910	37·12	2	36·2426	......	......	......

Weighted mean ...... +38·39
V_a ...... −23·39
V_d ...... − ·21
Curvature ...... − ·28

Radial velocity ...... +14·5

β ORIONIS 1442.

1908. Mar. 30.
G. M. T. 12h 49m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3596	......	......	......	2	58·8129	......	......	......
2	61·3220	3175	·1052	+43·36	1½	36·1715	·1572	·1091	+38·25
1½	59·7322	·7220	·0982	40·06	2	36·1666	......	......	......

Weighted mean ...... +40·84
V_a ...... −23·39
V_d ...... − ·21
Curvature ...... − ·28

Radial velocity ...... +17·0

β ORIONIS 1448.

1908. April 3.
G. M. T. 12h 16m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3573	......	......	......	2	58·8206	......	......	......
2½	61·3387	61·3037	·1232	+50·93	1½	36·2340	36·2126	·1184	+41·63
1½	59·7541	59·7160	·1195	48·89	2	36·2156	......	......	......

Weighted mean ...... +48·02
V_a ...... −22·69
V_d ...... − ·16
Curvature ...... − ·28

Radial velocity ...... +24·9

β ORIONIS 1449.

1908. April 3.
G. M. T. 12h 28m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3266	....	....	....	2	58·7829	....	....	....
2	61·3045	61·3024	·1219	+50·39	2	36·2068	36·2285	·1380	+48·52
1½	59·7338	59·7320	·1355	55·43	2	36·1722	....	....	....

Weighted mean		+51·08
V_a	−22·69	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+27·9

β ORIONIS 1450.

908. April 3.
G. M. T. 12h 40m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3216	....	....	....	2	58·7768	....	....	....
2	61·3092	61·3124	·1319	+54·53	1	36·2098	36·2325	·1420	+49·93
1½	59·7388	59·7428	·1463	59·85	2	36·1714	....	....	....

Weighted mean		+55·28
V_a	−22·69	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+32·2

β ORIONIS 1451.

1908. April 3.
G. M. T. 12h 53m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3301	....	....	....	2	58·7860	....	....	....
2	61·3062	61·3007	·1202	+49·69	1½	36·2164	36·2275	·1370	+48·47
1½	59·7310	59·7260	·1295	52·98	2	36·1830	....	....	....

Weighted mean		+50·22
V_a	−22·69	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+27·1

β ORIONIS 1457.

1908. April 4.
G. M. T. 12^h 19^m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3698	....	....	....	2	58·8305	....	....	....
3	61·3515	61·3069	·1264	+52·25	2	36·2996	36·2580	·1638	+57·59
2	59·7708	59·7224	·1259	51·51	2	36·2358	....	....	....

Weighted mean	+53·56
V_a	−22·41
V_d	−·22
Curvature	−·28
Radial velocity	+29·9

β ORIONIS 1458.

1908. April 4.
G. M. T. 12^h 28^m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3566	....	....	....	2	58·8112	....	....	....
2	61·3314	61·3004	·1199	+49·57	1½	36·2475	36·2460	·1551	+54·67
1½	59·7500	59·7196	·1231	50·36	2	36·1956	....	....	....

Weighted mean	+51·34
V_a	−22·40
V_d	−·23
Curvature	−·28
Radial velocity	+27·4

β ORIONIS 1459.

1908. April 4.
G. M. T. 12^h 38^m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3648	....	....	....	2	58·8227	....	....	....
3	61·3354	61·2944	·1139	+47·09	1½	36·2782	36·2500	·1625	+57·1
1½	59·7562	59·7150	·1185	48·47	2	36·2194	....	....	....

Weighted mean	+49·93
V_a	−22·40
V_d	−·23
Curvature	−·28
Radial velocity	+27·0

β ORIONIS 1469.

1908. April 13.
G. M. T. 12h 10m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
......	63·3830	....	....	....	.....	58·8337	....	....	....
.....	61·4037	....	....	....	......	36·1867	....	....	....
$2\frac{1}{2}$	61·3453	·3210	·1087	+44·81	1	36·2037	·1690	·1209	+42·38
$1\frac{1}{2}$	59·7340	·7090	·1852	34·75					

Weighted mean		+42·03
V_a	−20·23	
V_d	− ·28	
Curvature	− ·28	
Radial velocity		+21·3

β ORIONIS 1470.

1908. April 13.
G. M. T. 12h 22m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
......	63·3425	....	....	....	.....	58·7861	....	....	....
.....	61·3570	....	....	....	......	36·1305	....	....	....
......	61·3030	·3230	·1107	+45·63	.....	36·1485	·1700	·1219	+42·73
......	59·7213	·7440	·1202	49·03					

Weighted mean		+45·75
V_a	−20·23	
V_d	− ·25	
Curvature	− ·28	
Radial velocity		+25·0

β ORIONIS 1471.

1908. April 13.
G. M. T. 12h 34m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity
....	63·3504	....	....	....	....	58·7960	....	....	....
.....	61·3650	....	....	....	.....	36·1787	....	....	....
$2\frac{1}{2}$	61·3036	·3156	·1033	+42·58	$1\frac{1}{2}$	36·1611	·1876	·1395	+48·89
$1\frac{1}{2}$	59·7275	·7400	·1162	47·40					

Weighted mean		+45·61
V_a	−20·23	
V_d	− ·26	
Curvature	− ·28	
Radial velocity		+24·8

β ORIONIS 1873.

1908. Sept. 7. Observed by J. B. CANNON.
G. M. T. 21^h 52^m Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3948	....	....	....	2	58·8286	....	....	....
2	61·4080	....	....	....	2	36·1061	....	....	....
2	61·2458	·2498	·0068	+2·18	1	35·9859	·9890	·0168	−5·87
2	59·6682	·6722	·0208	+8·46					

Weighted mean	+ 3·08
V_a	+25·29
V_d	+ ·09
Curvature	− ·28
Radial velocity	+28·2

β ORIONIS 1874.

1908. Sept. 7. Observed by J. B. CANNON.
G. M. T. 22^h 10^m Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3952	....	....	....	2	58·8342	....	....	....
2	61·4064	....	....	....	2	36·1037	....	....	....
2	61·2468	·2495	·0050	+2·06	1	35·9972	·0025	·0033	−1·15
2	59·6584	·6600	·0086	+3·50					

Weighted mean	+ 1·99
V_a	+25·29
V_d	+ ·09
Curvature	− ·28
Radial velocity	+27·1

β ORIONIS 1935.

1908. Oct. 13. Observed by } J. S. PLASKETT.
G. M. T. 21^h 19^m Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3985	....	....	....	2	58·8313	....	....	....
2	61·4043	....	....	....	2	36 1175	....	....	....
2	61·2224	·2270	·0175	−7·19	1	36·0062	·9982	·0076	−2·66
1	59·6723	·6760	·0210	+8·54					

Weighted mean	− 2·00	
V_a		+20·66
V_d	− ·05	
Curvature	− ·28	
Radial velocity		+18·3

β ORIONIS 1936.

1908. Oct. 13.
G. M. T. 21h 48m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3626	....	....	....	2	58·7965	....	....	....
2	61·3762	....	....	....	2	36·0878	....	....	....
3	61·1940	·2285	·0160	−6·58	1	35·9778	·0000	·0058	−2·03
1½	59·6216	·6576	·0062	+2·52					

Weighted mean..............	− 3·27	
V_a..............	....	+20·66
V_d..............	− ·10	
Curvature.......	− ·28	
Radial velocity..................		+17·0

β ORIONIS 1937.

1908. Oct. 13.
G. M. T. 22h 19m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3670	....	....	....	2	58·8030	....	....	....
2	61 3727	....	....	....	2	36·0830	....	....	....
2	61·2064	·2414	·0031	−1·27	½	36·9604	·9875	·0183	−6·50
1	59·6093	·6423	·0091	3·70					

Weighted mean..............	− 2·71	
V_a..............	....	+20·65
V_d..............	− ·14	
Curvature.......	− ·28	
Radial velocity..................		+17·5

β ORIONIS 1938.

1908. Oct. 13.
G. M. T. 22h 47m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3806	....	....	....	2	58·8156	....	....	....
2	61·3922	....	....	....	2	36·1048	....	....	....
3	61·2124	·2304	·0141	− 5·80	1	35·9790	·9840	·0218	− 7·62
2	59·6301	·6386	·0128	5·20					

Weighted mean..............	− 5·90	
V_a..............	....	+20·65
V_d..............	− ·18	
Curvature.......	− ·28	
Radial velocity..................		+14·3

β ORIONIS 1978.

1908. Nov. 21.
G. M. T. $18^h 24^m$

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3468	....	... .	....	2	58 7938	....	....	....
2	61·3628	....	....	....	2	36·1436	......	....	....
1	61·2132	·2282	·0159	+ 6·55	½	36·0681	·0766	·0285	+ 9·9[illegible]
½	59·6547	·6700	·0462	18·75					

Weighted mean .... +10·46
V_a .... + 6·82
V_d .... − ·02
Curvature .... − ·28

Radial velocity .... +17·0

β ORIONIS 1979.

1908. Nov. 21.
G. M. T. $18^h 43^m$

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3061	....	....	....	2	58·7652	....	....	....
2	61·3300	....	....	.. ..	2	36·1120	....	....	....
1½	61·1662	·2174	....	....	½	36·0187	·0587	·0106	+ 3·7
1	59·6141	·6591	·0353	+14·39					

Weighted mean .... +10·83
V_a .... + 6·82
V_d .... − ·05
Curvature .... − ·28

Radial velocity .... +17·3

β ORIONIS 1980.

1908. Nov. 21.
G. M. T. $19^h 05^m$

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings,	Disp^t in rev^{ns}	Velocity
2	63·3533	. . ....	....	....	2	58·7995	....	....	....
2	61·3671	....	....	....	2	36·1350	... .	....	....
3	61·2382	·2480	·0357	+14·72	1½	36·0917	·1090	·0609	+21·34
2	59·6646	·6745	·0507	20·58					

Weighted mean .... +18·08
V_a .... + 6·82
V_d .... − ·09
Curvature .... − ·28

Radial velocity .... +24·5

β ORIONIS 1981.

1908. Nov. 21.
G. M. T. $19^h\ 33^m$

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3651	....	....	....	2	58·8100	....	....	....
2	61·3788	....	....	....	2	36·1536	....	....	....
3	61·2564	·2540	·0417	+17·19	1	36·1135	·1120	·0639	+22·40
1½	59·6711	·6700	·0462	18·75					

Weighted mean..................		+ 18·56
V_a..................		+ 6·82
V_d............	− ·13	
Curvature.....	·28	
Radial velocity..............		+ 25·0

β ORIONIS 1984.

1908. Nov. 28.
G. M. T. $16^h\ 05^m$

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3672	....	....	....	2	58·8125	....	....	....
2	61·3818	....	....	....	2	36·1472	....	....	....
3	61·2562	·2518	·0395	+16·28	2	36·1186	·1236	·0755	+26·47
1½	59·6454	6418	·0180	7·34					

Weighted mean		+17·35
V_a..................		+ 3·79
V_d..................		+ ·15
Curvature......	− ·28	
Radial velocity......		+21·0

β ORIONIS 1985.

1908. Nov. 28.
G. M. T. $16^h\ 34^m$

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·4001	....	....	....	2	58·8418	....	....	....
2	61·4112	....	....	....	2	36·1728	....	....	....
3	61·2867	·2527	·0405	+16·65	1½	36·1352	·1155	·0674	+23·63
2	59·7043	·6713	·0475	19·37					

Weighted mean..................		+ 19·10
V_a..................		+ 3·79
V_d..................		+ ·10
Curvature.....	− ·28	
Radial velocity.......		+ 22·7

β ORIONIS 1986.

1908. Nov. 28.
G. M. T. 17^h 08^m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·3743	....	......	....	2	58·8170	....	....	....
2	61·3865	....	......	....	2	36·1450	....	....	....
3	61·2439	·2340	·0217	+ 8·94	2	36·1220	·1290	·0869	+28·36
1½	59·6728	·6645	·0407	16·60					

Weighted mean..................		+16·91
V_a..................		+ 3 79
V_d..................		+ ·05
Curvature......	− ·28	
Radial velocity................		+20·5

β ORIONIS 1987.

1908. Dec. 1.
G. M. T. 17^h 53^m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·3748	....	....	....	2	58·8267	....	....	....
2	61·3934	....	....	....	2	36·2127	....	....	....
2	61·2490	·2005	·0200	+ 8·33	1	36·1757	·1573	·0668	+23·14
1	59·6824	·6385	·0420	17·13					

Weighted mean....................		+14·31
V_a....................		+ 2·42
V_d.	− ·04	
Curvature	− ·28	
Radial velocity................		+16·4

β ORIONIS 1988.

1908. Dec. 1.
G. M. T. 18^h 18^m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·3353	....	....	....	2	58·7876	....	....	....
2	61·3527	....	....	....	2	36·1671	....	....	....
2	61·2276	·2515	·0392	+16·16	1	36·1272	·1123	·0643	+22·54
1	59·6515	·6735	·0497	20·27					

Weighted mean..................		+18·78
V_a..................		+ 2·42
V_d.........	− ·09	
Curvature	− ·28	
Radial velocity.		+20·9

β ORIONIS 1989.

1908. Dec. 1.
G. M. T. 18h 36m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3437	....	....	....	2	58·7973	....	....	....
2	61·3587	....	....	....	2	36·1794	....	....	....
2	61·2166	·2335	·0212	+ 8·74	1½	36·1287	·1015	·0535	+18·75
½	59·6620	·6760	·0522	21·29					

Weighted mean.................. +14 06
V_a...................... + 2·42
V_d............ − ·12
Curvature ..... − ·28

Radial velocity................ +16·1

β ORIONIS 1990.

1908. Dec. 1.
G. M. T. 18h 52m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
......	63 3478	....	....	....	......	58·8000	....	....	....
......	61·3679	....	....	....	......	36·1850	....	....	....
3	61·2397	·2520	·0397	+16·36	1	36·1648	·1320	·0839	+29·41
2	59·6724	·6830	·0592	24·15					

Weighted mean .... +21·13
V_a...................... + 2·41
V_d............ − ·16
Curvature...... − ·28

Radial velocity..................... +23·1

β ORIONIS 2003.

1908. Dec. 5.
G. M. T. 16h 10m

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
.	63·3465	....	....	....	......	58·8090	....	....	....
......	61·3690	....	....	....	...	36·2298	....	....	....
3	61·2456	·2215	·0410	+16·95	1	36·2074	·1715	·0810	+28·48
1½	59·6764	·6518	.0553	22·62					

Weighted mean..................... +22·16
V_a...................... + ·63
V_d .... + ·10
Curvature..... − ·28

Radial velocity..................... +22·6

β ORIONIS 2004.

1908. Dec. 5.
G. M. T. $16^h\ 22^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·3170	....	....	.. ..	2	58·7790	....	....	....
2	61·3390	....	....	....	2	36·1924	....	....	....
2	61.2216	·2275	·0470	+19·43	1	36·1868	·1886	·0981	+34·49
½	59·6557	·6610	·0635	25·98					

Weighted mean .... +24·67
V_a .... + ·63
V_d .... + ·08
Curvature ..... − ·28

Radial velocity .... +25·1

β ORIONIS 2005.

1908. Dec. 5.
G. M. T. $16^h\ 38^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·3054	....	....	....	2	58·7707	.. ..	....	....
2	61·3304	....	....	....	2	36·1884	....	....	....
2½	61·2269	·2415	·0610	+25·22	1½	36·1715	·1775	·0870	+30·59
1½	59·6314	·6450	·0485	19·84					

Weighted mean .... +25·22
V_a .... + ·63
V_d .... + ·05
Curvature ..... − ·28

Radial velocity .... +25·6

β ORIONIS 2006.

1908. Dec. 5.
G. M. T. $16^h\ 53^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·3019	....	....	....	2	58·7614	....	....	....
2	61·3242	....	....	....	2	36·1852	....	....	....
3	61·2261	·2480	·0675	+27·90	1	36·1782	·1872	·0967	+34·00
1½	59·6262	·6480	.0515	21·07					

Weighted mean .... +27·14
V_a .... + ·63
V_d .... + ·03
Curvature ..... − ·28

Radial velocity .... +27·5

β ORIONIS 2054.

1908. Dec. 21.
G. M. T. 15^h 24^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Setting.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns.	Velocity.
......	54·7148	... .	....	....	... ...	53·0909	....	....	....
... ..	54·0045	... .	....	....	.. ..	45·2924	....	....	....
......	53·9654	·9630	·0198	22·90	......	45·2894	·2907	·0318	33 39
.....	53·4020	·4000	·0218	25·05					

Weighted mean .... +28·28
V_a .... − 6·51
V_d .... + ·04
Curvature .... − ·28

Radial velocity .... +21·5

β ORIONIS 2055.

1908. Dec. 21.
G. M. T. 15^h 29^m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7334	....	....	....	2	53·1065	....	... .	....
2	53·9890	·9690	·0258	+29·84	1	45·2957	·2907	·0318	+33·39
1½	53·4172	·3990	·0208	23·90	2	45·2891	....	....	....

Weighted mean .... +28·65
V_a ... . − 6·51
V_d .... + ·03
Curvature..... − ·28

Radial velocity .... +21·9

β ORIONIS 2057.

1908. Dec. 21.
G. M. T. 16^h 54^m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	56·6288	....	....	....	2	53·0900	....	....	....
2	54·7099	....	....	....	1½	45·2802	2926	·0327	+34·34
2	53·9683	·9695	·0263	+30·42	2	45·2730	....	....	....
1	53·4072	·4080	·0298	34·24					

Weighted mean .... +32·57
V_a .... − 6·53
V_d .... − ·07
Curvature ...... − ·28

Radial velocity .... +25·7

β ORIONIS 2058.

1908. Dec. 21.
G. M. T. 17h 00m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp't in rev'ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp't in rev'ns	Velocity.
2	56·6155	....	....	....	2	53·0753	....	....	....
2	54·6935	....	....	....	1½	45·2686	·2853	·0267	+28·04
1½	53·9424	·9585	·0143	+16·54	2	45·2681	....	....	....
1½	53·3996	·4140	·0358	41·14					

Weighted mean		+28·91
V_a	− 6·53	
V_d	− ·07	
Curvature	− ·28	
Radial velocity		+22·0

β ORIONIS 2065.

1908. Dec. 22.
G. M. T. 17h 38m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp't in rev'ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp't in rev'ns	Velocity.
2	63·3046	....	....	....	2	58·7699	....	....	....
2	61·3280	....	....	....	1	36·2329	....	....	....
1½	61·2436	·2278	·0792	+32·84	2	36·2528	·2560	·1230	+43·38
2	59·6639	·6520	·0828	33·55					

Weighted mean		+35·50
V_a	− 6·98	
V_d	− ·11	
Curvature	− ·28	
Radial velocity		+28·1

β ORIONIS 2066.

1908. Dec. 22.
G. M. T. 17h 52m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp't in rev'ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp't in rev'ns	Velocity.
2	63·2896	....	....	....	2	58·7610	....	....	....
2	61·3178	....	....	....	2	36·2286	....	....	....
3	61·2262	·2220	·0734	+30·43	1	36·2245	·2320	·0990	+34·92
1½	59·6270	·6245	·0553	22·68					

Weighted mean		+29·13
V_a	− 6·98	
V_d	− ·12	
Curvature	− ·28	
Radial velocity		+21·7

β ORIONIS 2067.

1908. Dec. 22.
G. M. T. 18h 02m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·2842	....	....	....	2	58·7512	....	....	....
2	61·3040	....	....	....	2	36·2038	....	....	....
2	61·2047	·2110	·0624	+25·87	1	36·2081	·2405	·1075	+37·92
1	59·6403	·6480	·0788	32·32					

Weighted mean..........................		+30·49
V_a..............	− 6·98	
V_d..............	− ·14	
Curvature.........	− ·28	
Radial velocity..........................		+23·1

β ORIONIS 2068.

1908. Dec. 22.
G. M. T. 18h 14m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·2842	....	....	....	2	58·7570	....	....	....
2	61·3115	....	....	....	2	36·2160	....	....	....
2	61·2151	·2160	·0674	+27·94	1	36·2098	·2300	·0970	+34·21
1	59·6468	·6483	·0791	32·45					

Weighted mean..........................		+30·63
V_a..............	− 6·98	
V_d..............	− ·14	
Curvature.........	− ·28	
Radial velocity..........................		+23·2

β ORIONIS 2070.

1908. Dec. 23.
G. M. T. 14h 00m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
3	63·2758	....	....	....	2	58·7363	....	....	....
2	61·2947	....	....	....	2	36·1449	....	....	....
3	61·1996	·2490	·0685	+28·32	½	36·1500	·1990	·1085	+38·15
1½	59·6100	·6580	·0615	25·16					

Weighted mean..........................		+28·36
V_a..............	− 7·36	
V_d..............		+ ·18
Curvature.........	− ·28	
Radial velocity..........................		+20·9

β ORIONIS 2071.

1908. Dec. 23.
G. M. T. 14h 40m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3263	....	....	....	2	58·7844	....	....	....
2	61·3499	....	....	....	2	36·2102	....	....	....
3	61·2612	·2580	·0775	+32·04	1	36·2124	·1964	·1059	+37·23
1	59·6928	·6920	·0935	38·25					

Weighted mean .... +34·32
V_a .... − 7·36
V_d .... + ·12
Curvature ...... − ·28

Radial velocity .... +26·8

β ORIONIS 2072.

1908. Dec. 23.
G. M. T. 15h 08m

Observed by J. B. Cannon.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3214	....	....	....	2	58·7812	....	....	....
2	61·3398	....	....	....	2	36·2100	....	....	....
2½	61·2460	·2500	·0695	+28·73	1	36·2152	·1995	·1090	+38·32
1½	59·6670	·6703	·0738	30·19					

Weighted mean .... +31·09
V_a .... − 7·36
V_d .... + ·09
Curvature .... − ·28

Radial velocity .... +23·5

β ORIONIS 2073.

1908. Dec. 23.
G. M. T. 15h 20m

Observed by / Measured by — J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·2965	....	....	....	2	58·7615	....	....	....
2	61·3207	....	....	....	2	36·1916	....	....	....
3	61·2222	·2470	·0665	+27·49	1	36·1928	·1954	·1049	+36·88
1½	59·6362	·6595	·0630	25·77					

Weighted mean .... +28·73
V_a .... − 7·36
V_d .... + ·07
Curvature ...... − ·28

Radial velocity .... +21·2

β ORIONIS 2075.

1908. Dec. 26. G. M. T. 15h 50m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3319	....	....	....	2	58·7877	....	....	....
2	61·3525	....	....	... .	2	36·1851	....	....	....
3	61·2697	·2622	·0817	+33·77	1½	36·1791	·1882	·0977	+34·45
1½	59·6900	·6850	·0885	36·21					

Weighted mean.................. +34 52
V_a .... − 8 68
V_d .... + ·01
Curvature........ − ·28

Radial velocity................ +25·6

β ORIONIS 2076.

1908. Dec. 26. G. M. T. 16h 00m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3051	....	....	....	2	58 7573	....	....	....
2	61·3204	.. ..	....	....	2	36·1624	....	....	... .
3	61·2357	·2590	·0785	+32·45	1½	36·1630	·1950	·1045	+36·74
1½	59·6614	·6874	·0919	37·60					

Weighted mean... .... +34·81
V_a .... − 8·68
V_d .... − ·01
Curvature........ − ·28

Radial velocity............... +25·9

β ORIONIS 2077.

1908. Dec. 26. G. M. T. 16h 09m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3424	....	....	. . ....	2	58·7943	....	....	....
2	61·3608	....	... .	....	2	36·1993	....	....	....
3	61·2612	*2450	·0645	+26·66	1½	36·2132	·2082	·1177	+41·38
1½	59·6842	·6730	·0765	31·30					

Weighted mean..... .... +31·48
V_a .... − 8·68
V_d .... − ·02
Curvature...... − ·28

Radial velocity............... +22·5

β ORIONIS 2078.

1908. Dec. 26.
G. M. T. 16h 18m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·3147	....	....	....	2	58·7684	....	....	....
2	61·3334	....	....	....	2	36·1610	....	....	....
2	61·2290	·2410	·0605	+25·01	1	36·1567	·1900	·0995	+34·98
½	59·6970	·7120	·1135	46·45					

Weighted mean....		+30·92
V_a	− 8·68	
V_d	− ·04	
Curvature...... ..	− ·28	
Radial velocity.		+22·0

β ORIONIS 2079.

1908. Dec. 27.
G. M. T. 14h 07m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·3248	....	....	....	2	58·7809	....	....	....
2	61·3453	....	....	....	2	36·1593	....	....	....
3	61·2754	·2750	·0945	+39·07	1	36·1787	·2140	.1235	+43·42
2	59·7087	·7115	·1150	47·05					

Weighted mean.......................		+42·45
V_a	− 9·08	
V_d		+ ·15
Curvature..........	− ·28	
Radial velocity........................		+33·2

β ORIONIS 2080.

1908. Dec. 27.
G. M. T. 15h 10m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity
2	63·3504	....	....	....	2	58·8064	....	....	....
2	61·3730	....	....	....	2	36·1823	....	....	....
3	61·3054	·2780	·0975	+40·31	½	36·1975	·2095	·1190	+41·84
1	59·7017	·6790	·0825	33·75					

Weighted mean.........		+39·02
V_a	− 9·08	
V_d		+ ·05
Curvature..........	− ·28	
Radial velocity.......		+ 29·7

β ORIONIS 2082.

1908. Dec. 31.
G. M. T. 15h 19m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7142	....	....	....	2	53·0938	....	....	....
2	54·0115	....	....	....	2	45 2860	·2855	·0368	+38 53
2	53·9684	·9790	·0221	+25·84	2	45·2716	....	....	....
2	53·4146	·4225	·0323	37·03					

Weighted mean..........		+ 33·80
V_a................	− 10·77	
V_d................	·00	
Curvature.........	− ·28	
Radial velocity..........		+ 22·7

β ORIONIS 2083.

1908. Dec. 31.
G. M. T. 15h 23m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7063	....	....	....	2	53·0866	....	....	....
2	54·0015	....	....	....	1½	45·2868	·2850	·0363	+38·00
2	53·9690	·9860	·0294	+33·92	2	45·2719	....	....	....
1	53 4065	·4215	·0313	35·88					

Weighted mean........................		+ 35·72
V_a................	− 10·77	
V_d................	·00	
Curvature.........	− ·28	
Radial velocity..................		+ 24·7

β ORIONIS 2084.

1908. Dec. 31.
G. M. T. 15h 29m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·6938	....	....	....	2	53·0745	....	....	....
2	53·9878	....	....	....	2	45·2702	·2812	·0325	+34·02
2	53·9587	·9880	·0314	+36·23	2	45·2600	....	....	....
1	53·3888	·4160	·0258	29·57					

Weighted mean........................		+ 34·01
V_a................	− 10·77	
V_d................	·00	
Curvature.........	− ·28	
Radial velocity..................		+ 23·0

β ORIONIS 2085.

1908. Dec. 31.
G. M. T. 15h 57m

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·6997	....	......	......	2	53·0777	....	......	....
2	53·9927	....	....	....	2	45·2854	·2895	·0408	+42·71
3	53·9592	·9835	·0269	+31·03	2	45·2717	....	....	....
1½	53·4022	·4255	·0353	40·46					

Weighted mean..		+ 37·57
V_a	− 10·77	
V_d	·00	
Curvature	− ·28	
Radial velocity		+ 26·5

β ORIONIS 2092.

1909. Jan. 6.
G. M. T. 16h 49m

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7150	....	....	....	2	53·0905	....	....	....
2	54·0102	....	....	....	1½	45·2713	·2730	·0243	+25·44
3	53·9756	9860	·0294	+33·92	2	45·2734	....	....	....
1½	53·4128	·4230	·0328	37·60					

Weighted mean		+32·72
V_a	−13·21	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+19·1

β ORIONIS 2093.

1909. Jan. 6.
G. M. T. 16h 53m

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings-	Disp^t in rev^ns	Velocity.
2	54·7120	....	....	....	2	53·0884	....	....	....
2	54·0046	....	....	....	2	45·2787	·2750	·0263	+27·43
3	53·9727	·9860	·0294	+33·92	2	45·2773	....	....	....
1½	53·4136	·4250	·0348	39·89					

Weighted mean		+33·30
V_a	−13·21	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+19·6

β ORIONIS 2094.

1909. Jan. 6.
G. M. T. 17^h 13^m

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7235	....	....	....	2	53·1074	....	....	....
2	54·0160	....	....	....	2	45·2957	·2830	·0343	+35·81
3	53·9867	·9850	·0284	+32·77	2	45·2876	....	....	....
2	53·4193	·4143	·0241	27·63					

Weighted mean		+32·17
V_a	−13·21	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+18·5

β ORIONIS 2095.

1909. Jan. 6.
G. M. T. 17^h 16^m

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	56·6440	....	....	....	2	53·0990	....	....	....
2	54·7198	....	....	....	2	45·2880	·2815	·0328	+34·34
2	53·9780	·9830	·0264	+30·46	2	45·2821	....	....	....
1	53·4356	·4380	·0478	54·79					

Weighted mean		+34·89
V_a	−13·21	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+21·2

β ORIONIS 2105.

1909. Jan. 7.
G. M. T. 12^h 49^m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7033	....	....	....	2	53·0832	....	....	....
2	53·9964	....	....	....	1	45·2868	....	....	....
3	53·9532	·9600	·0168	+19·43	2	45·2834	·2902	·0313	+32·87
1½	53·4150	·4215	·0433	49·76					

Weighted mean		+30·57
V_a	−13·59	
V_d	− ·11	
Curvature	− ·28	
Radial velocity		+16·8

β ORIONIS 2106.

1909. Jan. 7.
G. M. T. 13h 01m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7102	....	....	....	2	53·0883	....	....	....
2	54·0042	....	....	....	2	45·2895	....	....	....
3	53·9710	·9725	·0293	+33·89	1½	45·2880	·2920	·0331	+34·76
2	53·4114	·4125	·0343	39·41					

Weighted mean.... .... +35·79
V_a .... −13·59
V_d .... − ·11
Curvature. .... − ·28

Radial velocity............ .... +21·9

β ORIONIS 2107.

1909. Jan. 7.
G. M. T. 13h 04m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7028	....	....	....	2	53·0852	....	....	....
2	54·0000	....	....	....	2	36·2832	....	....	....
3	53·9603	·9653	·0221	+25·56	1½	36·2708	·2810	·0221	+23·21
1½	53·4016	·4060	·0278	31·94					

Weighted mean.... .... +26·57
V_a .... −13·59
V_d .... − ·11
Curvature....... − ·28

Radial velocity .... +12·8

β ORIONIS 2108.

1909. Jan. 7.
G. M. T. 13h 07m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7190	....	....	....	2	53·0925	....	....	....
1	54·0072	....	....	....	2	45·2938	....	....	....
2½	53·9772	·9715	·0283	+32·73	2	45·2933	·2931	·0342	+35·91
1½	53·4133	·4097	·0315	36·20					

Weighted mean................. +34·66
V_a . ... −13·59
V_d............ . − ·11
Curvature......... − ·28

Radial velocity .... +20·7

β ORIONIS 2111.

1909. Jan. 7.
G. M. T. $16^h\ 27^m$

Observed by } Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·3019	....	....	....	2	58·7700	....	....	....
2	61·3278	....	....	....	1½	36·2038	·2023	·0693	+24·46
2	61 2471	·2315	·0829	+34·37	2	36·2253	....	....	....
1	59·6883	·6760	·1068	43·81					

Weighted mean		+ 33·16
V_a	− 13·59	
V_d	− ·11	
Curvature	− ·28	
Radial velocity		+19·2

β ORIONIS 2112.

1909. Jan. 7.
G. M. T. $16^h\ 37^m$

Observed by } Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·2779	....	....	....	2	58·7484	....	....	....
2	61·3033	....	....	....	1½	36·2003	·2120	·0790	+27·86
3	61·2146	·2236	·0750	+31·51	2	36·2131	....	....	....
2	59·6353	·6455	·0763	31·30					

Weighted mean		+ 30·60
V_a	− 13·59	
V_d	− ·11	
Curvature	− ·28	
Radial velocity		+16·6

β ORIONIS 2114.

1909. Jan. 7.
G. M. T. $16^h\ 56^m$

Observed by } Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·2829	....	....	....	1	58·7582	....	....	....
2	61·3072	....	....	....	1½	36·1955	·2045	.0715	+25·22
3	61·2181	·2220	·0734	+30·43	2	36·2146	....	....	....
1½	59·6679	·6695	·1003	41·14					

Weighted mean		+ 31·80
V_a	− 13·59	
V_d	− ·11	
Curvature	− ·28	
Radial velocity		+17·8

β ORIONIS 2117.

1909. Jan. 8.
G. M. T. 15h 48m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·6880	....	....	....	2	53·0662	....	....	....
1	53·9760	....	....	....	2	45·2638	·2850	·0261	+27·41
2	53·9517	·9750	·0318	+36·78	2	45·2622	....	....	....
1	53·3882	·4113	·0331	38·04					

Weighted mean.. .... + 33·28
V_a .... − 13·96
V_d .... − ·09
Curvature....... − ·28

Radial velocity................. +18·9

β ORIONIS 2118.

1909. Jan. 8.
G. M. T. 15h 52m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7077	....	....	....	2	53·0872	....	....	....
2	53·9948	....	....	....	2	45·2898	·2935	·0346	+36·33
2	53·9690	·9730	·0298	+34·47	2	45·2837	....	....	....
1	53·4030	·4060	·0278	31·84					

Weighted mean.................... + 34·69
V_a .... − 13·96
V_d .... − ·09
Curvature.......... − ·28

Radial velocity .. .. + 20·3

β ORIONIS 2122.

1909. Jan. 12.
G. M. T. 11h 55m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7074	....	....	....	2	53·0858	....	....	....
2	53·9968	....	....	....	2	45·2886	....	....	....
1½	53·9694	·9735	·0303	+33·80	2	45·2856	·2905	·0316	+34·92
2	53·4238	·4275	·0493	54·97					

Weighted mean.................... + 41·91
V_a... .... − 15·39
V_d .... + ·23
Curvature.......... − ·28

Radial velocity................ + 26·5

β ORIONIS 2123.

1909. Jan. 12.
G. M. T. 11^h 59^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7088	....	....	....	2	53·0880	....	....	....
2	53·9990	....	....	....	2	45·2791	....	....	....
3	53·9836	·9836	·0428	+47·75	1	45·2727	·2890	·0301	+33·26
2	53·4085	·4105	·0323	36·01					

Weighted mean.................... + 41·42
V_a .... − 15·39
V_d .... + ·23
Curvature.......... − ·28

Radial velocity.................. + 26·0

β ORIONIS 2124.

1909. Jan. 12.
G. M. T. 12^h 09^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7008	....	....	....	2	53·0750	....	....	....
2	53·9928	....	....	....	2	45·2813	....	....	....
3	53·9598	·9700	·0268	+29·90	2	45·2783	·2905	·0316	+34·92
1½	53·4100	·4225	·0443	49·39					

Weighted mean.................... + 35·97
V_a .... − 15·39
V_d .... + ·23
Curvature.......... − ·28

Radial velocity.................. + 20·5

β ORIONIS 2125.

1909. Jan. 12.
G. M. T. 12^h 12^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7110	....	....	....	2	53·0858	....	....	....
2	54·0045	....	....	....	2	45·2870	....	....	....
4	53·9770	·9775	·0343	+38·27	2	45·2840	·2905	·0316	+34·92
3	53·4077	·4105	·0323	36·01					

Weighted mean.................... +36·77
V_a .... −15·39
V_d .... + ·23
Curvature.......... − ·28

Radial velocity.................. +21·3

β ORIONIS 2126.

1909. Jan. 12.
G. M. T. 12^h 15^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7047	....	....	....	2	53·0813	....	....	....
2	54·0000	....	....	....	2	45·2910	....	....	....
2½	53·9770	·9830	·0398	+44·40	1	45·2885	2910	·0321	+35·47
1½	53·4113	·4180	·0398	44·37					

Weighted mean........................		+42·60
V_a	−15·39	
V_d		+ ·23
Curvature........	− ·28	
Radial velocity........................		+27·2

β ORIONIS 2127.

1909. Jan. 12
G. M. T. 12^h 18^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7144	....	....	....	2	53·0960	....	....	....
2	54·0082	....	....	....	2	45·2991	....	....	....
2½	53·9767	·9765	·0333	+37·15	2	45·3000	·2945	·0356	+39·34
1½	53·4291	·4224	·0442	49·28					

Weighted mean........................		+40·91
V_a	−15·39	
V_d		+ ·23
Curvature........	− ·28	
Radial velocity........................		+25·5

β ORIONIS 2128.

1909. Jan. 13.
G. M. T. 15^h 36^m

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7086	....	....	....	2	53·0920	....	....	....
2	54·0031	....	....	....	2	45·2968	....	....	....
2	53,9775	·9790	·0358	+41·41	2	45·3012	2980	·0391	+41·06
2	53·4281	·4275	·0493	56·65					

Weighted mean........................		+46·37
V_a	−15·81	
V_d	− ·09	
Curvature........	− ·28	
Radial velocity........................		+30·2

β ORIONIS 2129.

1909. Jan. 13.
G. M. T. 15^h 41^m

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54 7082	....	....	....	2	53·0893	....	....	....
2	54·0002	....	....	....	2	45·2978	....	....	....
2½	53·9730	·9748	·0316	+36·54	1½	45·2852	·2810	·0221	+23·20
1½	53·4061	·4068	·0286	32·86					

Weighted mean....................		+31·90
V_a	−15·81	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+15·7

β ORIONIS 2130.

1909. Jan. 13.
G. M. T. 15^h 46^m

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·6985	....	....	....	2	53·0813	....	....	....
2	53·9934	....	....	....	2	45·2892	....	....	....
2	53·9782	·9880	·0448	+51·82	2	45·2940	·2984	·0395	+41·48
1	53·4029	·4115	·0333	38·26					

Weighted mean......................		+44·97
V_a	−15·81	
V_d	− ·09	
Curvature	− ·28	
Radial velocity..................		+28·8

β ORIONIS 2142.

1909. Jan. 15.
G. M. T. 15^h 11^m

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7058	....	....	....	2	53·0911	....	....	....
2	53·9996	....	....	....	2	45·2970	....	....	....
1	53·9752	·9790	·0358	+41·40	2	45·3055	·3021	·0432	+45·36
2	53·4083	·4105	·0323	37·14					

Weighted mean.......		+41·28
V_a	−16·50	
V_d	− ·04	
Curvature..........	− ·28	
Radial velocity..................		+24·5

β ORIONIS 2141.

1909. Jan. 15.
G. M. T. 14h 54m

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in Revns	Velocity.
2	56·6150	....	....	....	2	53·0735	....	....	....
2	54·7025	....	....	....	2	45·2772	....	....	....
2	53·9628	·9778	·0346	+40·02	3	45·2777	·2940	·0351	+36·86
1	53·3821	·3975	·0193	22·18					

Weighted mean..................		+35·47
V_a..............	−16·50	
V_d..............	− ·04	
Curvature........	− ·28	
Radial velocity..............		+18·6

β ORIONIS 2143.

1909. Jan. 15.
G. M. T. 15h 15m

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7162	....	....	....	2	53·0946	....	....	....
2	54·0069	....	....	....	2	45·2937	....	....	....
3	53·9895	·9844	·0412	+47·65	2	45·3062	·3061	·0472	+49·56
1½	53·4092	·4040	·0258	29·65					

Weighted mean.......		+44·08
V_a.......	−16·50	
V_d............	− ·04	
Curvature......	− ·28	
Radial velocity............		+27·2

β ORIONIS 2144.

1909. Jan. 15.
G. M. T. 15h 19m

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7053	....	....	....	2	53·0782	....	....	....
2	53·9945	....	....	....	2	45·2864	....	....	....
1	53·9672	·9750	·0318	+36·78	2	45·2847	·2920	·0331	+34·76
1	53·4103	·4200	·0418	48·03					

Weighted mean		+38·58
V_a.........	−16·50	
V_d..........	− ·04	
Curvature....	− ·28	
Radial velocity.............		+21·8

β ORIONIS 2151.

1909. Jan. 16.
G. M. T. 12h 25m

Observed by
Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·6926	....	....	....	2	53·0657	....	....	....
2	53·9756	....	....	....	2	45·2780	....	....	....
1	53·9598	·9850	·0418	+48·25	3	45·2970	·3130	·0541	+56·61
2	53·3854	·4104	·0322	36·00					

Weighted mean		+ 48·35
V_a	− 16·82	
V_d		+ ·13
Curvature	− ·28	
Radial velocity		+ 31·4

β ORIONIS 2152.

1909. Jan. 16.
G. M. T. 12h 36m

Observed by
Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·6990	....	....	....	2	53·0859	....	....	....
2	53·9982	....	....	....	2	45·2919	....	....	....
2	53·9738	·9820	·0388	+44·78	2	45·2978	·2995	·0406	+42·63
1	53·4168	·4210	0428	48·18					

Weighted mean		+44·60
V_a	−16·82	
V_d		+ ·13
Cur vature	− ·28	
Radial velocity		+27·6

β ORIONIS 2153.

1909. Jan. 16.
G. M. T. 12h 44m

Observed by
Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7003	....	....	....	2	53·0787	....	....	....
2	54·0022	....	....	....	2	45·2970	....	....	....
2	53·9786	·9886	·0454	+52·51	3	45·3131	·3100	·0511	+53·66
1	53·4072	·4160	·0378	43·44					

Weighted mean		+ 51·38
V_a	− 16·82	
V_d		+ ·13
Curvature	− ·28	
Radial velocity		+ 34·4

β ORIONIS 2154.

1909. Jan. 16.
G. M. T. $12^h\ 52^m$

Observed by } Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity
2	56·6114	....	....	....	2	53·0724	....	....	....
2	54·6911	....	....	....	2	45·2845	....	....	....
2	53·9844	·0025	·0593	+68·59	2	45·3008	·3100	·0511	+53·6
1½	53·4059	·4220	·0438	49·23					

Weighted mean....................		+ 57·88
V_a....................	−16·82	
V_d....................	+	·13
Curvature....................	− ·28	
Radial velocity....................		+ 40·9

β ORIONIS 2155.

1909. Jan. 16.
G. M. T. $12^h\ 59^m$

Observed by } Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity
2	56·6278	....	....	....	2	53·4202	·4220	·0438	49·2
2	54·7078	....	....	....	2	53·0880	....	....	....
2	54·0014	....	....	....	2	45·2940	....	....	....
2	53·9853	·9875	·0443	+51·03	2	45·3136	·3130	·0541	+53·6

Weighted mean....................		+ 51·01
V_a....................	−16·82	
V_d....................	+	·13
Curvature....................	− ·28	
Radial velocity....................		+ 33·0

β ORIONIS 2156.

1909. Jan. 16.
G. M. T. $13^h\ 12^m$

Observed by } Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity
2	54·7101	....	....	....	2	53·0934	....	....	....
2	54·0028	....	....	....	2	45·3008	....	....	....
4	53·9856	·9845	·0413	+47·77	3	45·3214	·3140	·0551	+58·[illegible]
2	53·4297	·4250	·0468	53·78					

Weighted mean....................		+ 52·82
V_a....................	−16·82	
V_d....................	+	·13
Curvature....................	− ·28	
Radial velocity....................		+ 35·8

β ORIONIS 2157.

1909. Jan. 17.
G. M. T. 13h 48m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·6992	....	....	....	2	53 0802	....	....	....
2	53·9936	....	....	....	2	45·2896	....	....	....
3	53·9741	[illegible]	·0418	+48·34	2	45·3062	·3102	·0513	+53·87
1	53·3965	[illegible]	·0273	31·37					

Weighted mean........................		+ 47 35
V_a	−17·17	
V_d		+ ·05
Curvature............	− ·28	
Radial velocity.....		+29·9

β ORIONIS 2158.

1909. Jan. 17.
G. M. T. 13h 56m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·6898	....	....	....	2	53·0742	....	....	....
2	53·9898	....	....	....	2	45·2874	....	....	....
2	53·9655	·9835	·0403	+46·61	2	45·2947	·3010	·0421	+44·21
2	53·3969	·4130	·0348	39·99					

Weighted mean........................		+43·60
V_a	−17·17	
V_d		+ ·05
Curvature	− ·28	
Radial velocity...................		+26·2

β ORIONIS 2161.

1909. Jan. 18.
G. M. T. 12h 41m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7073	....	....	....	2	53·0908	....	....	....
2	53 9976	....	....	....	2	45·2916	....	....	....
2	53·9851	·9880	·0448	+51·81	2½	45·3141	·3160	·0571	+59·96
1½	53·4217	·4220	·0438	50·37					

Weighted mean........................		+54·84
V_a	−17·17	
V_d		+ ·05
Curvature	− ·28	
Radial velocity...........		+37·1

β ORIONIS 2162.

1909. Jan. 18.
G. M. T. 12^h 46^m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	54·7174	....	....	....	2	53·0979	....	....	....
2	54·0111	....	....	....	2	45·3097	....	....	....
3	53·9987	·9900	·0468	+54·12	2	45·3267	·3105	·0516	+54·19
2	53·4185	·4098	·0316	36·34					

Weighted mean		+49·06
V_a	−17·17	
V_d		+ ·05
Curvature	− ·28	
Radial velocity		+31·3

β ORIONIS 2163.

1909. Jan. 18.
G. M. T. 12^h 51^m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	54·7067	....	....	....	2	53·0858	....	....	....
2	53·9965	....	....	....	2	45·2994	....	....	....
3	53·9771	·9820	·0388	+44·87	2	45·3122	·3064	·0475	+49·88
1	53·4107	·4147	·0365	41·94					

Weighted mean		+46·05
V_a	−17·51	
V_d		+ ·08
Curvature	− ·28	
Radial velocity		+28·3

β ORIONIS 2164.

1909. Jan. 18.
G. M. T. 13^h 06^m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	54·7077	....	....	....	2	53·0867	....	....	....
2	53·9990	....	....	....	2	45·2983	....	....	....
2	53·9926	·9954	·0521	+59·16	3	45·3107	·3060	·0471	+49·46
2	53·4235	·4261	·0479	54·04					

Weighted mean		+53·54
V_a	−17·57	
V_d		+ ·08
Curvature	− ·28	
Radial velocity		+35·8

β ORIONIS 2165.

1909. Jan. 18.
G. M. T. 13h 10m

Observed by } Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7128	....	....	....	2	53·0967	....	....	....
2	54·0073	....	....	....	2	45·3114	....	....	....
3	53·9885	·9830	·0398	+45·93	2	45·3277	·3100	·0571	+53·66
1	53·4284	·4215	·0433	48·66					

Weighted mean		+48·96
V_a	−17·57	
V_d		+ ·08
Curvature.........	− ·28	
Radial velocity		+31·2

β ORIONIS 2166.

1909. Jan. 18.
G. M. T. 13h 14m

Observed by } Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7106	....	....	....	2	53·0896	....	....	....
2	53·9998	....	....	....	2	45·3060	....	....	....
1½	53·9796	·9805	·0373	+43·14	3	45·3184	·3065	·0471	+49·46
1½	53·4221	·4225	·0443	50·95					

Weighted mean.......		+48·25
V_a	−17·57	
V_d		+ ·08
Curvature.........	− ·28	
Radial velocity.....		+30·5

β ORIONIS 2177.

1909. Jan. 26.
G. M. T. 10h 36m

Observed by } Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7218	....	....	....	2	53·0968	....	....	....
2	54·0098	....	....	....	2	45·2904	....	....	....
2	53·9936	·9856	·0424	+49·04	2	45·2922	·2954	·0365	+38·33
1	53·4276	·4200	·0418	48·03					

Weighted mean....................		+44·55
V_a	−19·95	
V_d		+ ·22
Curvature.........	− ·28	
Radial velocity.......		+24·6

β ORIONIS 2178.

1909. Jan. 26.
G. M. T. 10h 51m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7537	....	....	....	2	53·1294	....	....	....
2	54·0433	....	....	....	2	45·3207	....	....	....
3	54·0181	·9766	·0334	+38·63	1	45·3132	·2861	·0272	+28·56
1½	53·4554	·4150	·0368	42·29					

Weighted mean........................		+37·80
V_a	−19·95	
V_d		+ ·22
Curvature............	− ·28	
Radial velocity......................		+17·8

β ORIONIS 2179.

1909. Jan. 26.
G. M. T. 10h 56m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7468	....	....	....	2	53·1221	....	....	....
2	54·0423	....	....	....	2	45·3160	....	....	....
2	54·0140	53·9780	·0348	+40·25	2	45·3215	·2990	·0401	+42·11
1½	53·4594	·4260	·0478	54·93					

Weighted mean........................		+44·93
V_a	−19·95	
V_d		+ ·22
Curvature............	− ·28	
Radial velocity......................		+24 9

β ORIONIS 2180.

1909. Jan. 26.
G. M. T. 11h 01m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7250	....	....	....	2	53·1036	....	....	....
2	54·0212	....	....	....	2	45·2950	....	....	....
2½	53·9934	·9770	·0338	+39·09	1½	45·3008	·2994	·0405	+42·53
1	53·4420	·4270	·0488	56·08					

Weighted mean........................		+43·52
V_a	−19·95	
V_d		+ ·22
Curvature............	− ·28	
Radial velocity......................		+23·5

β ORIONIS 2181.

1909. Jan. 26.
G. M. T. 11ʰ 11ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7250	....	....	....	2	53·0986	....	....	....
2	54·0155	....	....	....	2	45·2998	....	....	....
3	53·9908	·9780	·0358	+41·40	1½	45·3051	·2990	·0401	+42·11
1	53·4287	·4180	·0398	45·73					

Weighted mean....................		+42·38
V_a..................	−19·95	
V_d..........		+ ·22
Curvature......... .	− ·28	
Radial velocity...............		+22·4

β ORIONIS 2182.

1909. Jan. 26.
G. M. T. 11ʰ 16ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7440	....	....	....	2	53·1178	....	....	....
2	54·0407	....	....	....	2	45·3090	....	....	....
2	54·0083	·9770	·0338	+39·09	2	45·3066	·2912	·0323	+33·92
½	53·4372	·4080	·0298	34·24					

Weighted mean....................		+36·25
V_a..............	−19·95	
V_d..........		+ ·22
Curvature.........	− ·28	
Radial velocity...............		+16·2

β ORIONIS 2183.

1909. Jan. 26.
G. M. T. 11ʰ 21ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7394	....	....	....	2	53·1107	....	....	....
2	54·0262	....	....	....	2	45·2972	....	....	....
3	54·0003	·9760	·0328	+37·93	2	45·3035	·3000	·0411	+43·16
½	53·4399	·4175	·0393	45·14					

Weighted mean....................		+40·49
V_a..........	−19·95	
V_d............		+ ·22
Curvature.......	− ·28	
Radial velocity...............		+20·5

β ORIONIS 2184.

1909. Jan. 28.
G. M. T. 11h 21m

Observed by, Measured by } J. S. Plaskett.

Wt.*	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7322	....	....	....	2	53·1120	....	....	....
2	54·0224	....	....	....	2	45·3111	....	....	....
3	54·0007	·9800	·0368	+42·56	2	45·3122	·2947	·0358	+37·59
1	53·4160	·3940	·0158	18·16					

Weighted mean		+36·84
V_a	−20·51	
V_d		+ ·21
Curvature	− ·28	
Radial velocity		+16·3

β ORIONIS 2185.

1909. Jan. 28.
G. M. T. 11h 25m

Observed by, Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7073	....	....	....	2	53·0869	....	....	....
2	53·9993	....	....	....	2	45·2864	....	....	....
2	53·9800	·9830	·0398	+46·03	2	45·2882	·2954	·0365	+38·33
1	53·4194	·4220	·0438	50·33					

Weighted mean		+43 81
V_a	−20·51	
V_d		+ ·21
Curvature	− ·29	
Radial velocity		+23·2

β ORIONIS 2186.

1909. Jan. 28.
G. M. T. 11h 29m

Observed by, Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7073	....	....	....	2	53·0851	....	....	....
2	54·0002	....	....	....	2	45·2893	....	....	....
2	53·9697	·9735	·0303	+35·04	2	45·2888	·2930	·0341	+35·81
1	53·4020	·4060	·0278	31·94					

Weighted mean		+34·73
V_a	−20·51	
V_d		+ ·21
Curvature	− ·28	
Radial velocity		+14·2

β ORIONIS 2187.

1909. Jan. 28.
G. M. T. 11h 41m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7131	....	....	....	2	53·0944	....	....	....
2	54·0015	....	....	....	2	45·2911	....	....	... .
2	53·9731	·9705	·0273	+31·57	2	45·2883	·2908	·0318	+33·39
1½	53·4183	·4140	·0358	41·14					

Weighted mean		+34·84
V_a	−20·51	
V_d		+ ·21
Curvature	− ·28	
Radial velocity.		+14·3

β ORIONIS 2188.

1909. Jan. 28.
G. M. T. 11h 44m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7128	....	....	....	2	53·0905	....	....	....
2	54·0033	....	....	....	2	45·2924	....	... .	....
2	53·9628	·9614	·0182	+21·05	1½	45·2857	·2869	·0280	+29·40
1½	53·4200	·4187	·0405	46·54					

Weighted mean		+31·20
V_a	−20·51	
V_d		+ ·21
Curvature	− ·28	
Radial velocity		+10·6

β ORIONIS 2189.

1909. Jan. 28.
G. M. T. 11h 47m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7175	....	....	....	2	53·1003	....	....	....
2	54·0085	....	....	....	2	45·2987	... .	....	....
2	53·9802	·9730	·0298	+34·46	1½	45·2937	·2886	·0397	+41·69
1½	53·4243	·4150	·0368	42·29					

Weighted mean		+38·98
V_a	−20·51	
V_d		+ ·21
Curvature	− ·28	
Radial velocity		+18·4

β ORIONIS 2195.

1909. Jan. 29.
G. M. T. 12^h 53^m

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7212	....	....	....	2	53·1014	....	....	....
2	54·0176	....	....	....	2	45·2906	....	....	....
2	53·9840	·9710	·0278	+32·15	1	45·2928	·2958	·0369	+38·75
1	53·4261	·4135	·0353	40·56					

Weighted mean..................		+35·90
V_a..............	−20·79	
V_d..................		+ ·05
Curvature........	− ·28	
Radial velocity..................		+14·9

β ORIONIS 2196.

1909. Jan. 29.
G. M. T. 12^h 57^m.

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7168	....	....	....	2	53·0946	....	....	....
2	54·0073	....	....	....	2	45·2894	....	....	....
3	53·9817	·9762	·0330	+38·16	1½	45·2877	·2919	·0330	+34·65
½	53·4324	·4270	·0488	56·08					

Weighted mean..................		+38·90
V_a..............	−20·79	
V_d..................		+ ·05
Curvature.......	− ·28	
Radial velocity..................		+17·9

β ORIONIS 2197.

1909. Jan. 29.
G. M. T. 13^h 01^m

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7222	....	....	....	2	53·0981	....	....	....
2	54·0097	....	....	....	2	45·2919	....	....	....
2	53·9881	·9790	·0358	+41·40	1	45·3034	·3050	·0461	+48·41
½	53·4480	·4390	·0608	69·87					

Weighted mean..................		+47·47
V_a..............	−20·79	
V_d..................		+ ·05
Curvature........	− ·28	
Radial velocity..................		+26·4

β ORIONIS 2198.

1909. Jan. 29.
G. M. T. $13^h\ 05^m$

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7170	....	....	....	2	53·0924	....	....	....
2	54·0100	....	....	....	2	45·2871	....	....	....
2	53·9896	·9840	·0408	+47·18	2	45·2927	·2992	·0403	+42·32
1½	53·4164	·4120	·0338	38·84					

Weighted mean .... + 43·14
V_a .... − 20·79
V_d .... + ·05
Curvature......... − ·28

Radial velocity........................ +22·1

β ORIONIS 2201.

1909. Jan. 30.
G. M. T. $12^h\ 29^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7150	....	....	....	2	53·0957	....	....	....
2	54·0093	....	....	....	2	45·2906	....	....	....
3	53·9791	·9730	·0298	+34·46	2	45·2884	·2914	·0325	+34·13
1	53·4193	·4130	·0348	39·99					

Weighted mean........................ + 35·27
V_a .... − 21·05
V_d .... + ·06
Curvature........ − ·28

Radial velocity.................... +14·0

β ORIONIS 2202.

1909. Jan. 30.
G. M. T. $12^h\ 41^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7150	....	....	....	2	53·5937	....	....	....
2	54·0022	....	....	....	2	45·2878	....	....	....
1½	53·9764	·9710	·0268	+30·99	2	45·2963	·3020	·0431	+45·26
1	53·4141	·4100	·0318	36·54					

Weighted mean........................ + 38·57
V_a .... − 21·05
V_d .... + ·06
Curvature....... − ·28

Radial velocity................... + 17·3

β ORIONIS 2203.

1909. Jan. 30.
G. M. T. $12^h\ 45^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7115	......	......	......	2	53·0902	......	......	......
2	53·9970	......	......	......	2	45·2808	......	......	......
1	53·9941	·9950	·0518	+59·91	2	45·2822	2950	·0361	+37·91
½	53·4224	·4240	·0458	52·63					

Weighted mean......		+46·29
V_a	−21·05	
V_d		+ ·06
Curvature.........	− ·28	
Radial velocity.........		+25·0

β ORIONIS 2204.

1909. Jan. 30.
G. M. T. $12^h\ 48^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7152	......	......	......	2	53·0917	......	......	......
2	54·0046	......	......	......	2	45·2933	......	......	......
1	53·9739	·9712	·0280	+32·38	2	45·2969	·2972	·0383	+40·22
1	53·4059	·4034	·0252	28·96					

Weighted mean.......		+35·45
V_a	−21 05	
V_d		+ ·06
Curvature.........	− ·28	
Radial velocity		+14·2

β ORIONIS 2205.

1909. Jan. 30.
G. M. T. $15^h\ 47^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3385	......	......	......	2	58·7894	......	......	......
2	61·3585	......	......	......	2	36·1737	......	......	......
3	61·2878	·2744	·0939	+38·82	1½	36·1979	·2180	·1275	+44·83
1½	59·7215	·7140	·1175	48·07					

Weighted mean..................		+42·63
V_a	−21·05	
V_d		+ ·06
Curvature.........	− ·28	
Radial velocity.........		+21·0

β ORIONIS 2206.

1909. Jan. 30.
G. M. T. $16^h\ 04^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3436	....	....	....	2	58·7994	....	....	....
2	61·3644	....	....	....	2	36·1900	....	....	....
2	61·3040	·2850	·1045	+43·20	1½	36·2046	·2088	·1173	+41·24
1½	59·7313	·7150	·1185	48·48					

Weighted mean .... +44·20
V_a .... −21·10
V_d .... − ·24
Curvature .... − ·28

Radial velocity .... +22·6

β ORIONIS 2207.

1909, Jan. 30.
G. M. T. $16^h\ 24^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3410	....	....	....	2	58·7983	....	....	....
2	61·3604	....	....	....	2	36·1943	....	....	....
3	61·3037	·2880	·1075	+44·44	2	36·2027	·2026	·1121	+39·41
1½	59·7308	·7160	·1195	48·89					

Weighted mean .... +43·92
V_a .... −21·10
V_d .... − ·24
Curvature .... − ·28

Radial velocity .... +22·3

β ORIONIS 2211.

1909, Jan. 31.
G. M. T. $17^h\ 16^m$

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7191	....	....	....	2	53·0951	....	....	....
2	54·0068	....	....	....	2	45·2834	....	....	....
2	53·9870	·9800	·0368	+42·56	2	45·2806	·2908	·0319	+33·50
1	53·4342	·4275	·0493	56·65					

Weighted mean .... +41·75
V_a .... −21·33
V_d .... − ·31
Curvature .... − ·28

Radial velocity .... +19·8

β ORIONIS 2212.

1909. Jan. 31. Observed by W. E. HARPER.
G. M. T. 17h 20m Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7084	....	....	....	2	53·0894	....	....	....
2	54·0012	....	....	....	2	45·2894	....	....	....
2	53·9833	·9835	·0403	+46·61	1½	45·2886	·2928	·0339	+35·60
1	53·4274	·4273	·0491	56·42					

Weighted mean.......................... +45·12
V_a .... −21·33
V_d .... − ·31
Curvature.................. − ·28

Radial velocity.......................... +23·2

β ORIONIS 2213.

1909. Jan. 31. Observed by W. E. HARPER.
G. M. T. 17h 24m Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7118	....	....	....	2	53·0904	....	....	....
2	54·0115	....	....	....	2	45·2938	....	....	....
2	53·9797	·9737	·0305	+35·27	2	45·2925	·2923	·0334	+35·07
1	53·4258	·4190	·0403	46·88					

Weighted mean.......................... +37·91
V_a .... −21·33
V_d .... − ·31
Curvature.................. − ·28

Radial velocity.......................... +16·0

β ORIONIS 2214.

1909. Jan. 31. Observed by W. E. HARPER.
G. M. T. 17h 29m Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7065	....	....	....	2	53·0873	....	....	....
2	53·9988	....	....	....	2	45·2835	....	....	....
1½	53·9808	9840	·0408	+47·18	2	45·2763	·2864	·0275	+28·88
1	53·4149	·4174	·0392	45·04					

Weighted mean.......................... +38·57
V_a .... −21·33
V_d .... − ·31
Curvature.................. − ·28

Radial velocity.......................... +16·6

β ORIONIS 2215.

1909. Feb. 2.
G. M. T. 11h 14m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7098	....	....	....	2	53·0885	....	....	....
2	54·0038	....	....	....	2	45·2951	....	....	....
2	53·9791	·9803	·0371	+42·90	2	45·3072	·3067	·0478	+50·19
2	53·4182	·4192	·0410	47·11					

Weighted mean		+46·73
V_a	−21·79	
V_d		+ ·14
Curvature	− ·28	
Radial velocity		+24·8

β ORIONIS 2216.

1909. Feb. 2.
G. M. T. 11h 23m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7162	....	....	....	2	53·0940	....	....	....
2	54·0091	....	....	....	2	45·3030	....	....	....
3	53·9864	·9810	·0378	+43·72	2	45·3047	·2953	·0364	+38·22
2	53·4299	·4250	·0468	53·78					

Weighted mean		+45·02
V_a	−21·79	
V_d		+ ·14
Curvature	− ·28	
Radial velocity		+23·1

β ORIONIS 2217.

1909. Feb. 2.
G. M. T. 11h 26m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7143	....	....	....	2	53·0916	....	....	....
1	54·0053	....	....	....	2	45·2940	....	....	....
3	53·9820	·9790	·0358	+41·40	2	45·3032	·3028	·0439	+46·10
1	53·4303	·4277	·0495	56·88					

Weighted mean		+45·35
V_a	−21·79	
V_d		+ ·14
Curvature	− ·28	
Radial velocity		+23·6

β ORIONIS 2218.

1909. Feb. 2.
G. M. T. $11^h\ 29^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7101	...	...	...	2	53·0910	...	...	...
2	54·0023	...	...	...	2	45·2961	...	...	...
2	53·9848	·9845	·0413	+47·76	2	45·3020	·2995	·0406	+42·63
1	53·4172	·4160	·0378	43·44					

Weighted mean		+44·44
V_a	−21·97	
V_d		+ ·14
Curvature	− ·28	
Radial velocity		+22·5

β ORIONIS 2219.

1909. Feb. 2.
G. M. T. $11^h\ 41^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7180	...	...	...	2	53·0937	...	...	...
2	54·0106	...	...	...	2	45·3002	...	...	...
3	53·9813	·9740	·0308	+35·62	2	45·3032	·2966	·0377	+39·59
1½	53·4213	·4150	·0368	42·29					

Weighted mean		+38·39
V_a	−21·79	
V_d		+ ·14
Curvature	− ·28	
Radial velocity		+16.5

β ORIONIS 2220.

1909, Feb. 2.
G. M. T. $11^h\ 45^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7143	...	...	...	2	53·0952	...	...	...
2	54·0073	...	...	...	2	45·2903	...	...	...
3	53·9847	·9800	·0368	+42·56	2	45·2967	·3000	·0411	+43·16
1	53·4305	·4250	·0468	53·78					

Weighted mean		+44·63
V_a	−21·79	
V_d		+ ·14
Curvature	− ·28	
Radial velocity		+22·7

β ORIONIS 2220*

1909, Feb. 2.
G. M. T. 11^h 45^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7580	....	....	....	3	53·1366	....	....	....
2	54·0249	·9779	·0347	+40·03	2	45·3355	·3006	·0417	+43·78
1½	53·4623	·4151	·0369	42·40	3	45·3285	....	....	....

Weighted mean .... +42·04
V_a .... −21·79
V_d .... + ·14
Curvature.... − ·28

Radial velocity............... +20·2

* Check.

β ORIONIS 2236.

1909, Feb. 6.
G. M. T. 12^h 29^m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7129	....	....	....	2	53·0895	....	....	....
2	54·0040	....	....	....	2	45·2921	....	....	....
2	53·9767	·9750	·0318	+36·78	3	45·2985	·3000	·0411	+43·16
1	53·4149	·4143	·0361	41·48					

Weighted mean.................. +40·75
V_a.......... −22·07
V_d.......... − ·24
Curvature.... − ·28

Radial velocity............... +18·2

β ORIONIS 2239.

1909, Feb. 6.
G. M. T. 12^h 50^m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7144	....	....	....	2	53·0925	....	....	....
2	54·0085	....	....	....	2	45·2967	....	....	....
2	53·9843	·9810	·0378	+43·72	2	45·3043	·3012	·0423	+44·42
1½	53·4083	·4052	·0270	31·03					

Weighted mean.................. +42·62
V_a.......... −22·07
V_d.......... − ·24
Curvature.... − ·28

Radial velocity............... +20·0

β ORIONIS 2240.

1909. Feb. 6.
G. M. T. 12^h 52^m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7160	....	....	....	2	53·0936	....	....	....
2	54·0066	....	....	....	2	45·2951	....	....	....
2	53·9845	·9800	·0368	+42·56	1	45·2950	·2935	·0346	+36·33
2	53·4254	·4210	·0428	49·18					

Weighted mean....................	+43·96
V_a .... −22·07	
V_d .... − ·24	
Curvature.............. − ·28	
Radial velocity	+21·0

β ORIONIS 2241.

1909. Feb. 6.
G. M. T. 16^h 12^m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3172	....	....	....	2	58·7726	....	....	....
2	61·3357	....	....	....	2	36·1652	....	....	....
2	61·2768	·2858	·1053	+43·53	1½	36·1710	·2000	·1095	+38·00
1½	59·7176	·7280	·1315	54·10					

Weighted mean....................	+45·19
V_a .... −22·73	
V_d .... − ·30	
Curvature.............. − ·28	
Radial velocity....................	+21·9

β ORIONIS 2242.

1909. Feb. 6.
G. M. T. 16^h 43^m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean. of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3249	....	....	....	2	58·7845	....	....	....
2	61·3494	....	....	....	2	36·1810	....	....	....
2	61·2686	·2670	·0865	+35·76	1½	36·1972	·2104	·1199	+42·16
1½	59·7224	·7220	·1255	51·34					

Weighted mean....................	+42·36
V_a .... −22·73	
V_d .... − ·30	
Curvature.............. − ·28	
Radial velocity....................	+19·1

β ORIONIS 2243.

1909. Feb. 7.
G. M. T. 15h 11m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·3350	....	....	....	2	58·7918	....	....	....
2	61·3619	....	....	....	2	36·1731	....	....	....
2	61·2972	·2872	·1065	+44·03	2	36·1874	·2085	·1180	+41·77
1½	59·7234	·7150	·1185	48·48					

Weighted mean .... +44·42
V_a .... −22·93
V_d .... − ·23
Curvature .... − ·28

Radial velocity .... +21·0

β ORIONIS 2244.

1909. Feb. 7.
G. M. T. 15h 25m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·3380	....	....	....	2	58·7900	....	....	....
2	61·3554	....	....	....	2	36·1752	....	....	....
2	61·2952	·2855	·1050	+43·41	1½	36·1830	·2020	·1115	+39·20
1	59·7458	·7388	·1423	58·21					

Weighted mean .... +45·30
V_a .... −22·93
V_d .... − ·23
Curvature .... − ·28

Radial velocity .... +21·9

β ORIONIS 2245.

1909. Feb. 7.
G. M. T. 15h 37m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	63·3424	....	....	....	2	58·7988	....	....	....
2	61·3620	....	....	....	2	36·1867	....	....	....
1½	61·2862	·2692	·0887	+35·97	1	36·1858	·1963	·1058	+37·20
1	59·7488	·7338	·1373	56·05					

Weighted mean .... +41·45
V_a .... −22·93
V_d .... − ·23
Curvature .... − ·28

Radial velocity .... +18·0

β ORIONIS 2249.

1909. Feb. 8.
G. M. T. 13h 32m

Observed by T. H. Parker.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7050	....	....	....	2	53·0824	....	....	....
2	53·9998	....	....	....	2	45·2868	....	....	....
3	53·9795	·9845	·0413	+47·76	2	45·3024	·3092	·0503	+52·82
2	53·4276	·4375	·0593	68·14					

Weighted mean.........................		+ 55·03
V_a	−23·11	
V_d	− ·08	
Curvature	− ·28	
Radial velocity......................		+31·6

β ORIONIS 2250.

1909. Feb. 8.
G. M. T. 13h 36m

Observed by T. H. Parker.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·6972	....	....	....	2	53·0777	....	....	....
2	53·9910	....	....	....	2	45·2869	....	....	....
2	53·9713	·9835	·0403	+46·61	1½	45·2950	·3027	·0438	+45·99
1	53·4184	·4304	·0522	59·98					

Weighted mean.........................		+ 49·37
V_a	− 23·11	
V_d	− ·08	
Curvature	− ·28	
Radial velocity....................		+25·9

β ORIONIS 2251.

1909. Feb. 8.
G. M. T. 13h 41m

Observed by T. H. Parker.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7049	....	....	....	2	53·0838	....	....	....
2	53·9982	....	....	....	2	45·2878	....	....	....
2	53 9698	·9755	·0323	+37·35	1½	45·2914	·2972	·0383	+40·22
3	53·4168	·4225	·0443	50·91					

Weighted mean.........................		+44·27
V_a	− 23·11	
V_d	− ·08	
Curvature	− ·28	
Radial velocity....................		+21·8

β ORIONIS 2252.

1909. Feb. 8.
G. M. T. 14h 01m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7056	....	....	....	2	53·0882	....	....	....
2	53·9980	....	....	....	2	45·2960	....	....	....
1½	53·9779	·9815	·0383	+44·29	1½	45·2982	·2958	·0369	+38·75
½	53·4076	·4095	·0313	35·97					

Weighted mean		+41·05
V_a	−23·11	
V_d	− ·08	
Curvature	− ·28	
Radial velocity		+17·6

β ORIONIS 2253.

1909. Feb. 8.
G. M. T. 14h 05m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7217	....	....	....	2	53·1030	....	....	....
2	54·0110	....	....	....	2	45·3090	....	....	....
2	53·9862	·9762	·0330	+38·16	2	45·3240	·3086	·0497	+52·19
3	53·4354	·4230	·0448	51·48					

Weighted mean		+47·88
V_a	−23·11	
V_d	− ·08	
Curvature	− ·28	
Radial velocity		+24·1

β ORIONIS 2254.

1909. Feb. 8.
G. M. T. 14h 09m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7152	....	....	....	2	53·0993	....	....	....
2	54·0084	....	....	....	2	45·3112	....	....	....
2	53·9930	·9860	·0428	+49·50	2	45·3142	·2966	·0377	+39·59
1	53·4357	·4265	·0483	55·50					

Weighted mean		+46·74
V_a	−23·11	
V_d	− ·08	
Curvature	− ·28	
Radial velocity		+23·3

β ORIONIS 2265.

1909. Feb. 10.
G. M. T. 12h 07m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·6987	....	....	....	2	53·0767	....	....	....
2	53·9911	....	....	....	2	45·2770	....	....	....
2	53·9691	·9800	·0368	+42·56	2	45·2980	·3146	·0557	+58·49
1½	53·4197	·4310	·0528	60·67					

Weighted mean		+53·29
V_a	−23·48	
V_d		+ ·05
Curvature	− ·28	
Radial velocity		+29·6

β ORIONIS 2266.

1909. Feb. 10.
G. M. T. 12h 12m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7090	....	....	....	2	53·0932	....	....	....
2	54·0052	....	....	....	2	45·2916	....	....	....
2	53·9815	·9780	·0348	+40·25	2	45·2989	·3009	·0420	+44·10
2	53·4312	·4275	·0493	56·65					

Weighted mean		+47·00
V_a	−23·48	
V_d		+ ·05
Curvature	− ·28	
Radial velocity		+23·3

β ORIONIS 2267.

1909. Feb. 10.
G. M. T. 12h 16m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7055	....	....	....	2	53·0968	....	....	....
2	53·9982	....	....	....	2	45·2923	....	....	....
2	53·9744	·9780	·0348	+40·25	2	45·2994	·3007	·0418	+43·89
1½	53·4070	·4100	·0318	36·54					

Weighted mean		+40·56
V_a	−23·48	
V_d		+ ·05
Curvature	− ·28	
Radial velocity		+16·9

β ORIONIS 2268.

1909. Feb. 10.
G. M. T. $12^h\ 21^m$

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	54·7108	....	....	....	2	53·0920	....	....	....
2	54·0029	....	....	....	2	45·2948	....	....	....
2	53·9702	·9690	·0258	+29·84	2	45·2962	·2950	·0361	+37·91
1½	53·4186	·4160	·0378	43·44					

Weighted mean		+36·48
V_a	−23·48	
V_d		+ ·05
Curvature	− ·28	
Radial velocity		+12·8

β ORIONIS 2269.

1909. Feb. 10.
G. M. T. $12^h\ 33^m$

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	54·7094	....	....	....	2	53·0894	....	....	....
2	53·9959	....	....	....	2	45·2919	....	....	....
3	53·9814	·9830	·0398	+46·03	2	45·2979	·2996	·0407	+42·74
2	53·4142	·4145	·0363	41·71					

Weighted mean		+ 44·00
V_a	−23·48	
V_d		+ ·05
Curvature	− ·28	
Radial velocity		+ 20·3

β ORIONIS 2270.

1909. Feb. 10.
G. M. T. $12^h\ 37^m$

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp[t] in rev[ns]	Velocity.
2	54·7124	....	....	....	2	53·0940	....	....	....
2	54·0066	....	....	....	2	45·2995	....	....	....
2	53·9901	·9870	·0438	+49·50	2	45·3078	·3019	·0430	+45·15
1	53·4211	·4167	·0385	44·24					

Weighted mean		+ 46·71
V_a	−23·48	
V_d		+ ·05
Curvature	− ·28	
Radial velocity		+ 23·0

β ORIONIS 2272.

1909. Feb. 11.
G. M. T. 11h 26m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7167	....	....	....	2	53·0917	....	....	....
2	54·0032	....	....	....	2	45·2881	....	....	....
2	53·9806	·9785	·0353	+40·82	2	45·2997	·3052	·0463	+48·62
1½	53·4114	·4092	·0310	35·62					

Weighted mean		+ 42·78
V_a	− 23·65	
V_d		+ ·10
Curvature	− ·28	
Radial velocity		+ 18·9

β ORIONIS 2273.

1909. Feb. 11.
G. M. T. 11h 32m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7138	....	....	....	2	53·0875	....	....	....
2	54·0025	....	....	....	2	45·2844	....	....	....
2	53·9970	·9960	·0528	+61·06	2	45·3006	·3098	·0509	+53·45
1	53·4268	·4280	·0498	57·23					

Weighted mean		+ 57·25
V_a	− 23·65	
V_d		+ ·10
Curvature	− ·28	
Radial velocity		+ 33·4

β ORIONIS 2274.

1909. Feb. 11.
G. M. T. 11h 35m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7114	....	....	....	2	53·0881	....	....	....
2	54·0044	....	....	....	2	45·2877	....	....	....
2	53·9812	·9810	·0378	+43·72	2	45·3071	·3130	·0540	+56·81
1½	53·4353	·4360	·0578	66·42					

Weighted mean		+43·72
V_a	−23·65	
V_d		+ ·10
Curvature	− 28	
Radial velocity		+30·8

β ORIONIS 2275.

1909. Feb. 11.
G. M. T. $11^h\ 38^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7133	....	....	....	2	53·0921	....	....	....
2	54·0063	....	....	....	2	45·2911	....	....	....
3	53·9782	·9760	·0328	+36·78	2	45·2979	·3024	·0435	+45·68
2	53·4256	·4230	·0448	51·48					

Weighted mean....................		+43·52
V_a	−23·65	
V_d		+ ·10
Curvature.......	− ·28	
Radial velocity................		+19·7

β ORIONIS 2276.

1909. Feb. 11.
G. M. T. $11^h\ 46^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7082	....	....	....	2	53·0893	....	....	....
2	53·9963	....	....	....	2	45·2824	....	....	....
2	53·9792	·9840	·0408	+47·19	2	45·2835	·2947	·0358	+37·59
1	53·4083	·4095	·0313	35·97					

Weighted mean....................		+41·11
V_a	−23·65	
V_d		+ ·10
Curvature	− ·28	
Radial velocity................		+17·3

β ORIONIS 2277.

1909. Feb. 11.
G. M. T. $11^h\ 49^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7099	....	....	....	2	53·0878	....	....	....
2	54·0019	....	....	....	2	45·2944	....	....	....
2	53·9798	·9810	·0378	+43·72	1½	45·3021	·3013	·0424	+44·52
1	53·4279	·4294	·0512	58·83					

Weighted mean....................		+47·34
V_a	−23·65	
V_d		+ ·10
Curvature.......	− ·28	
Radial velocity................		+23·5

β ORIONIS 2278.

1909. Feb. 13.
G. M. T. 12h 27m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3466	....	....	....	2	58·8021	....	....	....
2	61·3632	....	....	....	2	36·1817	....	....	....
3	61·3156	·2975	·1175	+48·37	1	36·1930	·2055	·1150	+40·31
2	59·7290	·7110	·1145	46·84					

Weighted mean........................		+46·52
V_a	−24·00	
V_d	·00	
Curvature	− ·28	
Radial velocity........................		+22·2

β ORIONIS 2279.

1909. Feb. 13.
G. M. T. 12h 40m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3312	....	....	....	2	58·7858	....	....	....
2	61·3531	....	....	....	2	36·1657	....	....	....
3	61·3032	·2970	·1165	+48 16	1½	36·1698	·1983	·1078	+37·78
2	59·7212	·7180	·1215	49·71					

Weighted mean........................		+46·24
V_a	−24·00	
V_d	·00	
Curvature	− ·28	
Radial velocity........................		+22·0

β ORIONIS 2280.

1909. Feb. 13.
G. M. T. 12h 53m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3520	....	....	....	2	58·8035	....	....	....
2	61·3710	....	....	....	2	36·1748	....	....	....
3	61 3192	·2940	·1135	+46·92	1	36·1848	·2042	·1137	+39·85
2	59·7314	·7105	·1140	46·64					

Weighted mean........................		+45·65
V_a	−24·00	
V_d	·00	
Curvature	− ·28	
Radial velocity........................		+21·4

β ORIONIS 2284.

1909. Feb. 20.
G. M. T. 12^h 29^m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3507	....	....	....	2	58·8010	....	....	....
2	61·3686	....	....	....	2	36·1520	....	....	....
3	61·2988	·3100	·0977	+40·27	2	36·1728	·1730	·1249	+43·78
1	59·7346	·7440	·1202	49·33					

Weighted mean....................		+42·95
V_a..................	−24·82	
V_d..................	− ·08	
Curvature	− ·28	
Radial velocity....................		+17·7

β ORIONIS 2285.

1909. Feb. 20.
G. M. T. 13^h 05^m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3177	....	....	....	2	58·7696	....	....	....
2	61·3352	....	....	....	2	36·1246	....	....	....
2	61·2860	·3278	·1155	+47·61	1½	36·1377	·1653	·1172	+41·08
1	59·7262	·7665	·1427	58·21					

Weighted mean....................		+ 47·79
V_a..................	− 24·82	
V_d..................	− ·08	
Curvature	− ·28	
Radial velocity....................		+ 22·6

β ORIONIS 2286.

1909. Feb. 20.
G. M. T. 15^h 12^m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3440	....	....	....	2	58·7989	....	....	....
2	61·3648	....	....	....	2	36·1571	....	....	....
2	61·3160	·3320	·1197	+49·34	1½	36·1733	·1684	·1203	+42·16
1	59·7233	·7245	·1007	41·08					

Weighted mean....................		+ 45·14
V_a..................	− 24·82	
V_d..................	− ·08	
Curvature	− ·28	
Radial velocity....................		+ 19·8

β ORIONIS 2288.

1909. Feb. 21.
G. M. T. $12^h 57^m$

Observed by }
Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3644	....	....	....	2	58·8118	....	....	....
2	61·3779	....	....	....	2	36·1550	....	....	....
2	61·3268	·3250	·1127	+46·45	1	36·1798	·1770	·1770	+45·18
½	59·7422	·7400	·1162	47·40					

Weighted mean........................		+ 46.45
V_a	− 25·04	
V_d	− ·09	
Curvature........	− ·28	
Radial velocity........................		+ 21·0

β ORIONIS 2289.

1909. Feb. 21.
G. M. T. $13^h 07^m$

Observed by }
Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3543	....	....	....	2	58·8071	....	....	....
2	61·3695	....	....	....	2	36·1572	....	....	....
2	61·3040	·3105	·0982	+40·48	2	36·1726	·1676	·1195	+41·88
1	59·7518	·7545	·1307	53·39					

Weighted mean........................		+ 45·62
V_a	− 25·04	
V_d	− ·09	
Curvature........	− ·28	
Radial velocity........................		+ 18·2

β ORIONIS 2290.

1909. Feb. 21
G. M. T. $13^h 17^m$

Observed by }
Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3632	....	....	....	2	58·8130	....	....	....
2	61·3830	....	....	....	2	36·1631	....	....	....
2	61·3238	·3200	·1077	+44 39	2	36·1767	·1658	·1177	+41·25
1	59 7450	·7415	·1177	48·01					

Weighted mean........................		+43·86
V_a	−25 04	
V_d	− ·09	
Curvature........	− ·28	
Radial velocity........................		+18·4

β ORIONIS 2291.

1909, Feb. 21.
G. M. T. 13h 27m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.
2	63·3650	....	....	....	2	58·8109	....	....	....
2	61·3777	....	....	....	2	36·1475	....	....	....
3	61·3190	·3170	·1047	+43·16	2	36·1659	·1706	·1225	+42·94
1½	59 7433	·7416	·1168	47·64					

Weighted mean		+44·13
V_a	−25·04	
V_d	− ·09	
Curvature.....	− ·28	
Radial velocity...		+18·7

β ORIONIS 2292.

1909, Feb. 22.
G. M. T. 12h 02m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.
2	63·3642	....	....	....	2	58·8102	....	....	....
2	61·3755	....	....	....	2	36·1595	....	....	....
2	61·3167	·3157	·1034	+42·62	1	36·1831	·1758	·1277	+44·76
1	59·7493	·7483	·1245	50·78					

Weighted mean..........		+45·19
V_a	−25·14	
V_d	− ·02	
Curvature.....	− ·28	
Radial velocity.....		+19·7

β ORIONIS 2293.

1909, Feb.22
G. M. T. 12h 15m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^{t} in rev^{ns}	Velocity.
2	63·3503	....	....	....	2	58·8000	....	....	....
2	61·3637	....	....	....	2	36·1558	....	....	....
2	61·3018	·3125	·1002	+41·30	½	36·1807	·1771	·1290	+45·21
1	59·7474	·7570	·1332	54·33					

Weighted mean..................		+45·58
V_a	−25·14	
V_d	− ·02	
Curvature.....	− ·28	
Radial velocity........		+25·1

β ORIONIS 2294.

1909. Feb. 22.
G. M. T. 12h 30m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3495	....	....	....	2	58·8022	....	....	....
2	63·3678	....	....	....	2	36·1610	....	....	....
2	61·3121	·3210	·1087	+44·81	2	36·1809	·1720	·1239	+43·43
1½	59·7381	·7458	·1220	49·76					

Weighted mean..................	+45·66
V_a	−25·14
V_d	− ·02
Curvature..........	− ·28
Radial velocity..................	+20·2

β ORIONIS 2295.

1909- Feb. 22.
G. M. T. 12h 42m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3622	....	....	....	2	58·8095	....	....	....
2	61·3780	....	....	....	2	36·1677	....	....	....
2	61·3248	·3280	·1157	+47·69	1½	36·1881	·1726	·1245	+43·64
2	59·7345	·7344	·1106	45·11					

Weighted mean..................	+45·65
V_a	−25·14
V_d	− ·02
Curvature..........	− ·28
Radial velocity..................	+20·2

β ORIONIS 2309.

1909. Feb. 27.
G. M. T. 11h 35m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3682	....	....	....	2	58·8129	....	....	....
2	61·3790	....	....	....	2	36·1491	....	....	....
2	61·3288	·3240	·1117	+46·04	2	36·1814	1845	·1364	+47·81
1½	59·7498	·7460	·1222	49·85					

Weighted mean..................	+47·71
V_a	−25·48
V_d	·00
Curvature..........	− ·28
Radial velocity..................	+22 0

β ORIONIS 2311.

1909. Feb. 28.
G. M. T. 11h 56m

Observed by / Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3272	....	....	....	2	58·7792	....	....	....
2	63·3402	....	....	....	2	36·1567	....	....	....
2	61·2899	·2940	·1135	+46·92	1½	36·1805	·2180	·1275	+44·83
1½	59·7215	·7250	·1285	52·63					

Weighted mean.		+48·01
V_a	−25·53	
V_d	− ·02	
Curvature	− ·28	
Radial velocity.		+22·2

β ORIONIS 2312.

1909. Feb. 28.
G. M. T. 12h 07m

Observed by / Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·2345	....	....	....	2	58·7913	....	....	....
2	61·3567	....	....	....	2	36·1739	....	....	....
3	61·2980	·2890	·1085	+44·85	2	36·2048	·2251	·1346	+47·33
2	59·7342	·7260	·1295	53·04					

Weighted mean.		+47·90
V_a	−25·53	
V_d	− ·02	
Curvature	− ·28	
Radial velocity.		+22·0

β ORIONIS 2313.

1909. Feb. 28.
G. M. T. 12h 18m

Observed by / Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3394	....	....	....	2	58·7911	....	....	....
2	61·3602	....	....	....	2	36·1740	....	....	....
2	61·3112	·3000	·1195	+49·40	1	36·1806	·2026	·1121	+39·41
1	59·7515	·7435	·1470	60·21					

Weighted mean.		+49·61
V_a	−25·53	
V_d	− ·02	
Curvature	− ·28	
Radial velocity.		+23·7

β ORIONIS 2314.

1909. Feb. 28.
G. M. T. 12h 27m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3298	....	....	....	2	58·7866	....	....	....
2	61·3467	....	....	....	2	36·1742	....	....	....
2	61·3037	·3005	·1200	+49·61	1½	36·1998	·2198	·1293	+45·46
1½	59·7434	·7408	·1443	59·11					

Weighted mean..........		+51·22
V_a	−25·53	
V_d	− ·02	
Curvature	− ·28	
Radial velocity..........		+25·3

β ORIONIS 2315.

1909. Feb. 28.
G. M. T. 12h 39m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3247	....	....	....	2	58·7759	....	....	....
2	61·3422	....	....	....	2	36·1541	....	....	....
3	61·2979	·3005	·1200	+49·61	2	36·1757	·2158	·1253	+44·06
1½	59·7148	·7215	·1250	51·14					

Weighted mean		+48·26
V_a	−25·53	
V_d	− ·02	
Curvature	− ·28	
Radial velocity..........		+22·4

β ORIONIS 2316.

1909. Feb. 28.
G. M. T. 12h 50m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3355	....	....	....	2	58·7887	....	....	....
2	61·3528	....	....	....	2	36·1782	....	....	....
2	61·2998	·2920	·1115	+46·09	1½	36·1944	·2105	·1200	+42·19
1½	59·7455	·7400	·1435	58·71					

Weighted mean..........		+48·71
V_a	−25·53	
V_d	− ·02	
Curvature	− ·28	
Radial velocity..........		+22·8

β ORIONIS 2317.

1909. Mar. 2.
G. M. T. 11h 20m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3647	....	....	....	2	58·8147	....	....	....
2	61·3807	....	....	....	2	36·1744	....	....	....
2	61·3360	·3320	·1197	+49·34	1½	36·1960	·1738	·1257	+44·06
2	59·7707	·7655	·1417	57·80					

Weighted mean..........................		+50·97
V_a	−25·61	
V_d	− ·02	
Curvature.........	− ·28	
Radial velocity.....................		+25·9

β ORIONIS 2318.

1909. Mar. 2.
G. M. T. 11h 19m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3626	....	....	....	2	59·8075	....	....	....
2	61·3804	....	....	....	2	36·1516	....	....	....
2	61·3217	·3210	·1087	+44·81	1½	36·1860	·1866	·1385	+48·54
2	59·7622	·7640	·1402	57·19					

Weighted mean..........................		+50·33
V_a	−25·61	
V_d	− ·02	
Curvature.........	− ·28	
Radial velocity.....................		+24·4

β ORIONIS 2319.

1909. Mar. 2.
G. M. T. 11h 29m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3438	....	....	....	2	58·7920	....	....	....
2	61·3600	....	....	....	2	36·1442	....	....	....
2	61·3090	·3260	·1137	+46·87	2	36·1763	·1843	·1363	+47·77
1½	59·7476	·7650	·1412	57·59					

Weighted mean..........................		+50·12
V_a	−25·61	
V_d	− ·02	
Curvature.........	− ·28	
Radial velocity.....................		+24·2

β ORIONIS 2320.

1909. Mar. 2.
G. M. T. 11ʰ 36ᵐ

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3522	....	....	....	2	58·7996	....	....	....
2	61·3707	....	....	....	2	36·1541	....	....	....
2	61·3197	·3290	·1167	+48·10	2	36·1921	·1902	·1421	+49·81
1½	59·7315	·7312	·1074	43·81					

Weighted mean.................. +47·55
V_a.......... −25·61
V_d.......... − ·02
Curvature.... − ·28

Radial velocity.............. +21·6

β ORIONIS 2364.

1909. Mar. 13
G. M. T. 12ʰ 12ᵐ

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity
2	63·3696	....	....	....	2	58·8115	....	....	....
2	61·3870	....	....	....	2	36·1448	....	....	....
2	61·3327	·3250	·1127	+46·5	1½	36·1611	·1685	·1204	+42·
1½	59·7380	·7320	·1082	44·1					

Weighted mean.................. +44·50
V_a.......... −25·45
V_d.......... − ·16
Curvature.... − ·28

Radial velocity.............. +18·6

β ORIONIS 2365.

1909. Mar. 13
G. M. T. 12ʰ 24ᵐ

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity
2	63·3760	....	....	....	2	58·8161	....	....	....
2	61·3876	....	....	....	2	36·1348	....	....	....
3	61·3228	·3120	·0997	+41·1	1½	36·1591	·1765	·1284	+45·
2	59·7507	·7425	·1187	48·4					

Weighted mean.................. +44·25
V_a.......... −25·45
V_d.......... − ·16
Curvature.... − ·28

Radial velocity.............. +18·4

β ORIONIS 2366.

1909. Mar. 13
G. M. T. $12^h 36^m$

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3662	....	....	....	2	58·8112	....	....	....
2	61·3821	....	....	....	2	36·1400	....	....	....
2	61·3198	·3160	·1037	+42·7	1½	36·1692	·1814	·1333	+46·7
1½	59·7506	·7475	·1237	50·4					

Weighted mean........		+46·21
V_a..........	−25·45	
V_d..........	− ·16	
Curvature....	− ·28	
Radial velocity...............		+20·3

β ORIONIS 2367.

1909. Mar. 13.
G. M. T. $12^h 46^m$

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3600	....	....	....	2	58·7981	....	....	....
2	61·3738	....	....	....	2	36·1272	....	....	....
2½	61·3086	·3125	·1002	+41·30	1½	36·1460	·1710	·1229	+43·10
1½	59·7297	·7400	·1162	47·40					

Weighted mean.......		+43·45
V_a	−25·45	
V_d.....	− ·16	
Curvature...... ..	− ·28	
Radial velocity..................		+17·6

β ORIONIS 2368.

1909. Mar. 13.
G. M. T. $12^h 57^m$

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3640	....	....	....	2	58·8093	....	....	....
2	61·3800	....	....	....	2	36·1354	....	....	....
2	61·3300	·3280	·1157	+47·7	1½	36·1578	·1746	·1265	+44·3
2	59·7306	·7300	·1062	43·3					

Weighted mean......................		+45·17
V_a....	−25·45	
V_d.............	− ·16	
Curvature...... ..	− ·28	
Radial velocity...................		+19·3

β ORIONIS 2372.

1909. Mar. 15.
G. M. T. $11^h 45^m$

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3472	....	....	....	2	58·8015	....	....	....
2	61·3664	....	....	....	2	36 1624	....	....	....
2	61·3098	·2890	·1085	+44·85	1½	36·1712	·2030	·1125	+39·55
1	59·7205	·7015	·1050	42·96					

Weighted mean.................... +42·66
V_a .... −25·34
V_d .... − ·14
Curvature........ − ·28

Radial velocity.................. +16·9

β ORIONIS 2373.

1909. Mar. 15.
G. M. T. $11^h 56^m$

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3475	....	....	....	2	58 7985	....	....	....
2	61·3660	....	....	....	2	36·1478	....	....	....
2½	61·3094	·2890	·1085	+44·85	1½	36·1697	·2161	·1256	+44·16
1	59·7421	·7260	·1295	52·98					

Weighted mean.................... +46·27
V_a .... −25·34
V_d .... − ·14
Curvature........ − ·28

Radial velocity.................. +20·5

β ORIONIS 2374.

1909. Mar. 15.
G. M. T. $12^h 05^m$

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity
2	63·3415	....	....	....	2	58·7942	....	....	....
2	61·3612	....	....	....	2	36·1598	....	....	....
2	61·2924	2764	·0959	+39·65	1½	36·1784	·2128	·1223	+43·0
1	59·7336	·7220	·1255	51·34					

Weighted mean.................... +43·36
V_a .... −25·34
V_d .... − ·14
Curvature........ − ·28

Radial velocity.................. +17·6

β ORIONIS 2375.

1909. Mar. 15.
G. M. T. 12^h 13^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3430	....	....	....	2	58·7960	....	....	....
2	61·3618	....	....	....	2	36·1654	....	....	....
2	61·3146	·2976	·1171	+48·41	1½	36·1837	·2125	·1223	+43·00
1½	59·7102	·6972	·1007	41 20					

Weighted mean .... +44·62
V_a .... −25·34
V_d ... . − ·14
Curvature......... − ·28

Radial velocity........................ +18·9

β ORIONIS 2376.

1909. Mar. 15.
G. M. T. 12^h 21^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3492	....	....	....	2	58·8022	....	....	....
2	61·3678	....	....	....	2	36·1743	....	....	....
2	61·3032	·2800	·0995	+41·13	1	36·1771	·1970	·1065	+37·45
1½	59·7281	·7088	·1123	45·94					

Weighted mean........ .. .. +41·92
V_a.. .... −25·34
V_d....... .... − ·14
Curvature.... .... − ·28

Radial velocity.................... . +16·2

β ORIONIS 2386.

1909. Mar. 18.
G. M. T. 11^h 42^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3427	....	....	....	2	58 7936	....	....	....
2	61·3610	....	....	....	2	36·1518	....	....	....
3	61·3020	·3185	·1062	+43·78	1	36·1820	·1824	·1343	+47·07
2	59·7188	·7346	·1108	45·20					

Weighted mean .... +44·98
V_a............... −25·09
V_d...... .... − ·15
Curvature......... − ·28

Radial velocity.... ... . +19·5

β ORIONIS 2387.

1909. Mar. 18.
G. M. T. 11h 52m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3645	....	....	....	2	58·8071	....	....	....
2	61·3782	....	....	....	2	36·1581	....	....	....
2	61·3205	·3200	·1077	+44 39	1	36·1684	·1625	·1144	+40·10
1½	59·7465	·7480	·1242	50·66					

Weighted mean.. .... +45·53
V_a .... −25·09
V_d.......... − ·15
Curvature..... − ·28

Radial velocity.................. +20·0

β ORIONIS 2388.

1909. Mar. 18.
G. M. T. 12h 02m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3541	....	....	....	2	58·8001	....	....	....
2	61·3718	....	....	....	2	36·1635	....	....	....
2	61·3210	·3280	·1157	+47·69	1½	36·1828	·1715	·1235	+43·29
1½	59·7396	·7480	·1242	50·66					

Weighted mean.................. +47·26
V_a......... −25·09
V_d.......... − ·15
Curvature.... − ·28

Radial velocity............... +21·7

β ORIONIS 2389.

1909. Mar. 18.
G. M. T. 12h 12m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3492	....	....	....	2	58·7998	....	....	....
2	61·3646	....	....	....	2	36·1597	....	....	....
1½	61·2927	·3050	·0927	+38·21	1½	36·1954	·1879	·1398	+49·00
2	59·7380	·7485	·1247	50·86					

Weighted mean................. +46·51
V_a.......... −25·09
V_d.......... − ·15
Curvature.... − ·28

Radial velocity............... +21·0

β ORIONIS 2390.

1909. Mar. 20.
G. M. T. $12^h\ 16^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3657	....	....	....	2	58·8128	....	....	....
2	61·3836	....	....	....	2	36·1496	....	....	....
2½	61·3307	·3260	·1137	+46·86	1½	36·1655	·1681	·1200	+42·06
1½	59·7601	·7561	·1323	53·96					

Weighted mean		+47·49
V_a.......... ..	−24·88	
V_d	− ·12	
Curvature........	− ·28	
Radial velocity....................		+22·2

β ORIONIS 2391.

1909. Mar. 20.
G. M. T. $12^h\ 26^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3724	....	....	....	2	58·8192	....	....	....
2	61·3859	....	....	....	2	36·1414	....	....	....
2	61·3292	·3192	·1069	+44·06	1½	36·1637	·1745	·1264	+44·30
1½	59·7392	·7292	·1054	42·99					

Weighted mean.............		+43·81
V_a......	−24·88	
V_d....	− ·12	
Curvature...........	− ·28	
Radial velocity........................		+18·3

β ORIONIS 2392.

1909. Mar. 20.
G. M. T. $12^h\ 38^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3775	....	....	....	2	58·8197	....	....	....
2	61·3892	....	....	....	2	36·1569	....	....	....
3	61·3352	·3320	·1197	+49·34	2	36·1862	·1815	·1334	+46·76
1½	59·7575	·7460	·1222	49·85					

Weighted mean....		+48·66
V_a................	−24·88	
V_d.............	− ·12	
Curvature...........	− ·28	
Radial velocity		+23·4

β ORIONIS 2393.

1909. Mar. 20.
G. M. T. 12h 48m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3659	....	....	....	2	58·8108	....	....	....
2	61·3800	....	....	....	2	36·1480	....	....	....
2	61·3215	·3184	·1061	+43·73	1½	36·1857	·1900	·1419	+49.74
1½	59·7468	·7448	·1210	49·36					

Weighted mean....................		+47·22
V_a..................	−24·88	
V_d..................	·12	
Curvature............	− ·28	
Radial velocity....................		+21·9

β ORIONIS 2394.

1909. Mar. 20.
G. M. T. 12h 58m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3661	....	....	....	2	58·8130	....	....	....
2	61·3815	....	....	....	2	36·1565	....	....	....
2½	61 3319	·3275	·1152	+47·49	1½	36·1806	·1763	·1282	+44·93
1½	59·7587	·7547	·1309	53·39					

Weighted mean....................		+48·40
V_a..................	−24·88	
V_d..................	− ·12	
Curvature............	− ·28	
Radial velocity....................		+23·1

β ORIONIS 2397.

1909. Mar. 21.
G. M. T. 13h 38m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3695	....	....	....	2	58·8189	....	....	....
2	61·3856	....	....	....	2	36·1752	....	....	....
2	61·2328	·3240	·1117	+46·07	1½	36·2220	·1990	·1509	+52·89
2	59·7550	·7460	·1222	49·85					

Weighted mean....................		+49·30
V_a..................	−24·76	
V_d..................	− ·32	
Curvature............	− ·28	
Radial velocity....................		+23·9

β ORIONIS 2398.

1909. Mar. 21.
G. M. T. 13h 48m

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3667	....	....	....	2	58·8120	....	....	....
2	61·3818	....	....	....	2	36·1571	....	....	....
2	61·3396	·3350	·1227	+50·60	2	36·2053	·2004	·1523	+53·38
2	59·7441	·7410	·1172	47·81					

Weighted mean..........................		+50·60
V_a....................	−24·76	
V_d....................	− ·32	
Curvature..............	− ·28	
Radial velocity..........................		+25·2

β ORIONIS 2399.

1909. Mar. 21.
G. M. T. 14h

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3483	....	....	....	2	58·7972	....	....	....
2	61·3664	....	....	....	2	36·1511	....	....	....
2	61·3124	·3245	·1122	+46·27	1	36·1884	·1894	·1414	+49·56
2	59·7452	·7572	·1334	54·41					

Weighted mean..........................		+50·18
V_a....................	−24 76	
V_d....................	− ·32	
Curvature..............	− ·28	
Radial velocity..........................		+24·8

β ORIONIS 2400.

1909. Mar. 21.
G. M. T. 14h 14m

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3505	....	....	....	2	58·8071	....	....	....
2	61·3712	....	....	....	2	36·1516	....	....	....
2	61·3198	·3300	·1177	+48·54	½	36·1855	·1861	·1380	+48.37
1½	59·7490	·7580	·1342	54·74					

Weighted mean..........................		+50·84
V_a....................	−24·76	
V_d....................	− ·32	
Curvature..............	− ·28	
Radial velocity..........................		+25·5

β ORIONIS 2402.

1909. Mar. 22.
G. M. T. 11h 51m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3584	....	....	....	2	58·8043	....	....	....
2	61·3737	....	....	....	2	36·1447	....	....	....
2	61·3370	·3410	·1287	+53·05	1½	36·1712	·1787	·1307	+45·81
1½	59·7510	·7560	·1322	53·92					

Weighted mean....................		+51·14
V_a	−24·66	
V_d	− ·16	
Curvature	− ·28	
Radial velocity....................		+26·0

β ORIONIS 2403.

1909. Mar. 22.
G. M. T. 12h 02m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3517	....	....	......	2	58·8009	....	....	....
2	61·3688	....	....	....	2	36·1536	....	....	....
2	61·3260	·3355	·1232	+50·78	1½	36·1846	·1832	·1832	+47·35
1½	59·7423	·7573	·1275	52·01					

Weighted mean....................		+50·12
V_a	−24 66	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+25·0

β ORIONIS 2404.

1909. Mar. 22.
G. M. T. 12h 13m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3608	....	....	....	2	58·8094	....	....	....
2	61·3126	....	....	....	2	36·1640	....	....	....
2	61·3242	·3260	·1137	+46·87	1½	36·1917	·1800	·1319	+46·23
1½	59·7329	·7335	·1107	45·15					

Weighted mean......................		+46·16
V_a	−24·66	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+21·1

β ORIONIS 2405.

1909. Mar. 22.
G. M. T. $12^h\ 35^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3570	....	....	....	2	58·8019	....	....	....
2	61·3713	....	....	....	2	36·1480	....	....	....
2	61·3138	·3228	·1105	+45·55	1½	36·1698	·1740	·1259	+44·13
1½	59·7375	·7450	·1212	49·44					

Weighted mean....................		+46·29
V_a	−24·66	
V_d............	− ·16	
Curvature	− ·28	
Radial velocity....................		+21·2

β ORIONIS 2420.

1909. Mar. 23.
G. M. T. $11^h\ 46^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3586	....	....	....	2	58·8059	....	....	....
2	61·3757	....	....	....	2	36·1332	....	....	....
1½	61·3160	·3190	·1067	+43·99	2	36·1699	·1889	·1408	+49·35
1½	59·7445	·7480	·1242	50·66					

Weighted mean....................		+48·14
V_a	− 24·54	
V_d............	− ·19	
Curvature	− ·28	
Radial velocity....................		+23·1

β ORIONIS 2421.

1909. Mar. 23.
G. M. T. $11^h\ 57^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3700	....	....	....	2	58·8151	....	....	....
2	61·3800	....	....	....	2	36·1310	....	....	....
2½	61·3418	·3358	·1235	+50·92	2	36·1608	·1820	·1339	+46·93
1½	59·7447	·7390	·1152	49·99					

Weighted mean....................		+49·36
V_a	− 24·54	
V_d............	− ·19	
Curvature	− ·28	
Radial velocity....................		+24·4

β ORIONIS 2422.

1909. Mar. 23.
G. M. T. 12ʰ 05ᵐ

Observed by }
Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	63·3572	....	....	....	2	58·8081	....	....	....
2	61·3728	....	....	....	2	36·1372	....	....	....
2	61·3253	·3290	·1177	+48·53	2	36·1920	·2070	·1589	+55·69
1	59·7348	·7370	·1132	46·17					

Weighted mean..............................		+50·92
V_a..............................	−24·54	
V_d..............................	− ·19	
Curvature..............................	− ·28	
Radial velocity..............................		+25·9

β ORIONIS 2423.

1909. Mar. 23.
G. M. T. 12ʰ 13ᵐ

Observed by }
Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	63·3787	....	....	....	2	58·8225	....	....	....
2	61·3936	....	....	....	2	36·1500	....	....	....
2	61·3330	·3170	·1047	+43·17	2	36·2082	·2104	·1623	+56·89
2	59·7696	·7551	·1313	53·56					

Weighted mean..............................		+51·21
V_a..............................	− 24·54	
V_d..............................	− ·19	
Curvature..............................	− ·28	
Radial velocity..............................		+26·2

β ORIONIS 2424.

1909. Mar. 23.
G. M. T. 12ʰ 27ᵐ

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity
2	63·3774	....	....	....	2	58·8212	....	....	....
2	61·3930	....	....	....	2	36·1341	....	....	....
1½	61·3425	·3275	·1152	+47·51	2	36·1822	·1997	·1516	+53·14
1½	59·7590	·7465	·1227	50·35					

Weighted mean..............................		+50·52
V_a..............................	−24·54	
V_d..............................	− ·19	
Curvature..............................	− ·28	
Radial velocity..............................		+25·5

β ORIONIS 2425.

1909. Mar. 23.
G. M. T. 12h 38m

Observed by J. B. Cannon.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velcity.
2	63·3650	... .	....	....	2	58·8098	....	....	... .
2	61·3793	....	....	....	2	36·1269	....	....	....
2	61·3350	·3327	·1204	+49·65	1½	36·1707	·1960	·1479	+51·84
1½	59·7498	·7490	·1252	51·07					

Weighted mean..............................		+50·72
V_a.....................	−25·54	
V_d.....	− ·19	
Curvature..	− ·28	
Radial velocity................		+25·7

P.—Plaskett.
P¹.—Parker.
H.—Harper.
C.—Cannon.
T.—Tribble.

OBSERVING RECORD AND DETAILED MEASURES OF θ AQUILÆ.

RECORD OF SPECTROGRAMS.

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure. G.M.T.		Duration.	Hour Angle at end.		Temperature Centigrade. Room.		Prism Box.		Slit Width.	Seeing.	Observer.	Remarks.
										Beginning.	End.	Beginning.	End.				
				1907.	h.	m.	m.	h.	m.								
θ Aquilæ ..	1038	IL	Seed 27..	Sept. 12..	15	15	41	1	55 W.	16·8	15·7	20·9	20·9	·0012	Good.....	T	
" ..	1050	"	" ..	" 18..	14	45	37	1	40 "	12·5	11·7	17·0	17·0	·0014	Unsteady.	T	
				1908													
" ..	1533	"	" ..	May 15..	20	54	25		28 E.	11·0	10·5	18·0	17·9	·0017	Good.....	H	
" ..	1544	"	" ..	" 18..	20	49	22		25 "	15·0	15·0	23·4	23·4	·0016	Hazy.....	H	
" ..	1576	"	" ..	June 3..	20	35	25		30 W.	12·5	13·0	18·3	18·3	·0015	Fair.. ...	H	
" ..	1583	"	" ..	" 5..	19	42	45		10 E.	14·5	14·1	24·5	24·4	·0016	"	P¹	
" ..	1604	"	" ..	" 12..	19	32	35		10 W.	15·5	14·7	24·8	24·6	·0017	"	P¹	
" ..	1605	"	" ..	" 12..	20	15	40		45 "	14·7	14·4	24·6	24·5	"	Good.....	P¹	
..	1626	"	" ..	" 22..	18	35	40		10 E.	17·5	17·5	23·8	23·8	·0015	Hazy....	P¹	
" ..	1634	"	" ..	" 24..	19	46	39	1	07 W.	18·5	18·0	27·5	27·5	"	Good....	H	
" ..	1643	"	" ..	" 26..	19	42	35	1	15 "	17·5	17·3	30·0	30·0	·0016	"	P¹	
" ..	1651	"	" ..	" 27..	18	45	30		20 "	19·1	18·7	23·4	23·3	·0014	"	P	
" ..	1659	"	" ..	July 3..	17	30	60		25 "	21·5	20·5	25·4	25·1	·0016	Hazy.....	H-P¹	
" ..	1679	"	" ..	" 8..	18	49	30	1	02 "	17·5	17·0	21·6	21·6	·0015	Good.....	H	
" ..	1691	"	" ..	" 10..	19	30	40	2	.. "	20·4	19·3	28·0	26·6	·0016	....	P¹	
" ..	1696	"	" ..	" 11..	19	10	40	1	40 "	25·4	24·4	29·7	29·7	·0015	....	P	
" ..	1704	"	" ..	" 13..	19	37	35	2	15 "	18·0	17·6	23·0	23·0	"	Good.. ..	P¹	
" ..	1708	"	" ..	" 14..	18	19	23		52 "	20·0	19·5	20·6	20·6	·0016	" . ..	H	
" ..	1716	"	" ..	" 15..	19	24	22	2	02 "	14·5	14·5	22·0	22·0	·0015	"	H	
" ..	1727	"	" ..	" 25..	16	20	42		5 E.	21·4	20·6	24·7	24·6	·0015	Fair......	P	
" ..	1730	"	" ..	" 26..	17	38	24		58 W.	22·0	21·5	23·6	23·6	"	Good.....	H	
" ..	1731	"	" ..	" 26..	18	07	33	1	32 "	21·5	21·5	"	"	"	"	H	
" ..	1732	"	" ..	" 27..	18	15	130	1	50 "	25·5	24·0	29·7	29·5	"	No good..	P	Clouds 100^{m}
" ..	1733	"	" ..	" 27..	20	10	40	3	45 "	23·4	23·0	29·5	29·5	"	Fair......	P¹	
" ..	1735	"	" ..	" 28..	17	49	22	1	17 "	25·0	24·0	29·8	29·7	·0016	Good.. ...	H	
" ..	1736	"	" ..	" 28..	18	08	17	1	34 "	24·0	25·0	29·7	29·7	"	"	H	
" ..	1747	"	" ..	" 30..	17	47	25	1	25 "	26·0	26·0	31·1	31·0	·0015	"	H	

" ..	1755	"	" ..	" 31..	17 52	25	1 36 "	19·0	18·7	25·5	25·6	"	"	P¹-H	
" ..	1756	"	" ..	" 31..	18 19	21	2 .. "	18·7	18·5	25·6	"	"	"	H	
" ..	1762	"	" ..	Aug. 5..	14 05	50	1 30 "	22·6	22·6	27·0	27·0	"	Fair	P	
" ..	1766	"	" ..	" 5..	16 29	38	35 "	21·6	21·6	26·8	26·8	"	....	P	
" ..	1767	"	" ..	" 5..	17 18	48	1 25 "	21·3	20·8	26·8	26·7	"	....	P	
" ..	1769	"	" ..	" 5..	18 48	30	2 47 "	20·5	20·	26·5	26·5	"	....	C	Windy.
" ..	1776	"	" ..	" 7..	17 00	40	1 15 "	19·0	19·3	23·6	23·6	"	Fair	P¹	
" ..	1777	"	" ..	" 7..	17 45	40	2 02 "	19·2	18·8	23·5	23·4	"	"	P¹-C	
" ..	1789	"	" ..	" 17..	18 18	34	3 11 "	21·5	20·5	26·2	26·1	"	Unsteady.	H	
" ..	1794	IIIL	" ..	" 19..	16 45	90	2 12 "	14·5	14·0	23·3	23·2	·0017	Good	H	Cloudy 26^m
" ..	1799	IL	" ..	" 20..	15 15	39	20 "	18·0	17·0	22·6	22·4	·0015	Fair	H	
" ..	1800	"	" ..	" 20..	15 47	25	47 "	17·0	17·0	22·4	22·3	"	Good	H	
" ..	1801	"	" ..	" 20..	16 42	29	1 43 "	17·0	16·5	22·3	22·2	"	Fair	H	
" ..	1807	"	" ..	" 21..	13 57	35	1 .. E.	20·2	19·8	25·4	25·2	"	"	C	Off 5^m
" ..	1808	"	" ..	" 21..	14 32	30	26 "	19·8	18·8	25·2	25·0	"	Good	C	
" ..	1810	"	" ..	" 21..	15 28	30	30 W.	18·4	18·4	25·4	25·4	"	"	C	
" ..	1811	"	" ..	" 22..	15 29	26	37 "	16·0	15·5	18·0	17·8	"	"	H	
" ..	1812	"	" ..	" 22..	15 56	25	1 03 "	15·5	16·0	17·8	"	"	"	H	
" ..	1813	"	" ..	" 22..	16 21	26	1 29 "	16·0	"	"	"	"	"	H	
" ..	1814	"	" ..	" 23..	15 48	27	1 02 "	18·0	17·5	20·5	20·5	"	Fair	H	
" ..	1815	"	" ..	" 23..	16 18	30	1 30 "	17·5	17·0	"	20·3	"	"	H	
" ..	1822	"	" ..	" 24..	16 56	32	2 15 "	14·7	14·4	23·0	22·8	"	Good	H	
" ..	1835	"	" ..	" 27..	14 02	35	25 .	18·6	18·6	23·2	23·2	"	"	C	
" ..	1864	"	" ..	Sept. 3..	16 17	55	2 30 W.	14·8	14·0	20·5	20·4	"	Smoky ...	P	
" ..	1875	"	" ..	" 8..	12 42	45	55 E.	21·0	20·4	22·9	22·9	"	Fair	P	
" ..	1876	"	" ..	" 8..	13 40	69	20 W.	20·4	18·6	"	22·7	"	Hazy	P	
" ..	1878	"	" ..	" 11..	15 00	60	1 47 "	22·6	20·5	28·2	28·0	"	"	C	

θ AQUILÆ 1038.

1907. Sept. 12.
G. M. T. 15^h 15^m

Observed by J. N. Tribble.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7334	....	....	....	½	27·3601	·4161	·0035	3·04
1	53·9733	·9818	·0120	+13·81	2	27·1906	....	....	....
2	53·1041	....	....	....	1½	11·7684	·8670	·0156	+11·68
2	45·2469	....	....	....	2	11·4086	....	....	....
1½	45·2273	·2540	·0153	15·97					

Weighted mean.................. +12·62
V_a.................. −20·23
V_d.................. − ·14
Curvature.................. − ·28

Radial velocity.................. − 8·0

θ AQUILÆ 1050.

1907. Sept. 18.
G. M. T. 14^h 45^m

Observed by } J. N. Tribble.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0318	....	....	....	2	45·2738	....	....	....
1	72·8699	·8031	·0156	−22·66	1½	45·2139	·2237	·0250	26·17
2	72·4635	....	....	....	½	27·3813	·4591	·0374	−32·59
2	54·0294	....	....	....	2	27·2441	....	....	....

Weighted mean.................. −26·06
V_a.................. −22·14
V_d.................. − ·14
Curvature.................. − ·28

Radial velocity.................. −48·6

θ AQUILÆ 1050.*

1907. Sept. 18.
G. M. T. 14^h 45^m

Observed by J. N. Tribble.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
1	73·0040	....	....	....	2	53·1850	....	....	....
½	72·8394	·8450	·0198	−28·73	2	45·2417	....	....	....
1	72·4318	....	....	....	1½	45·1800	·2119	·0268	27·98
2	54·7082	....	....	....	¼	27·3593	·3996	·0130	−11·28
½	53·9314	·9651	·0044	5·06	2	27·2063	....	....	....

Weighted mean.................. −22·43
V_a.................. −22·14
V_d.................. − ·14
Curvature.................. − ·28

Radial velocity.................. −45·0

* Check measurement.

θ AQUILÆ 1533.

1908. May 15.
G. M. T. 20^h 54^m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7742	....	....	....	2	27·2579	....	....	....
½	53·9093	·8781	·0917	−105·54	1½	15·3876	·3776	·0956	−73·99
2	53·1421	....	....	....	2	15·4086	....	....	....
2	45·2974	....	....	....	½	11·7542	·7520	·0994	−74·45
1½	45·1779	·1541	·0846	−88·32	2	11·5091	....	....	....
1½	27·3612	·3498	·0628	−54·51					

Weighted mean........................		−75·50
V_a..................	+26·05	
V_d..................	+ ·06	
Curvature....................		− ·28
Radial velocity........................		−49·7

θ AQUILÆ 1544.

1908. May 18.
G. M. T. 20^h 49^m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7267	....	....	....	2	45·2655	....	....	....
2½	53·8990	·9160	·0538	−61·92	½	45·1692	·1773	·0614	−64·10
2	53·0932	....	....	....					

Weighted mean........................		−62·30
V_a..................	+25·50	
V_d..................	+ ·04	
Curvature....................		− ·28
Radial velocity........................		−37·0

θ AQUILÆ 1576.

1908. June 3.
G. M. T. 20^h 35^m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7369	....	....	....	¾	45·1970	·1900	·0487	−50·84
2	53·8906	·8976	·0722	−83·10	1	11·8670	·7770	·0744	−55·72
2	53·1029	....	....	....	2	11·5975	....	....	....
2	45·2806	....	....	....					

Weighted mean........................		−69·34
V_a..................	+21·62	
V_d..................		− ·02
Curvature....................		− ·28
Radial velocity........................		−48·0

θ AQUILÆ 1583.

1908. June 5.
G. M. T. 9h 42m

Observed by T. H. Parker.
Measured by C. R. Westland.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9953	....	....	....	2	45·2607	....	....	....
1	72·8212	·8347	·0301	−43·68	1½	45·1648	·1776	·0611	−63·79
2	72·4342	....	....	....	1	27·3467	·3418	·0708	−61·45
2	54·7250	....	....	....	2	27·2518	....	....	....
2	53·9156	·9287	·0411	−47·31	2	11·8084	·7915	·0599	−44·87
2	53·1028	....	....	....	2	11·5245	....	....	....

Weighted mean		−51·35
V_a	+20·91	
V_d	+ ·04	
Curvature	−	·28
Radial velocity		−30·7

θ AQUILÆ 1604.

1908. June 12.
G. M. T. 19h 32m

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73 0475	....	....	....	2	45·2995	....	....	....
½	72·8819	·8436	·0212	−30 76	1	45·2281	·2022	·0365	−38·11
2	72·4848	....	....	....	1	37·7627	·7265	·0282	−27·21
2	57·8373	·7895	·0373	−44·91	2	37·9955	....	....	....
1	57·7974	....	....	....	1	27·4133	·3852	·0274	−23·78
2	54·7562	....	....	....	2	27·2746	....	....	....
2	53·9652	·9492	·0206	−23·71	1	11·8637	·8173	·0341	−25·54
2	53·1298	....	....	....	2	11·5542	....	....	....

Weighted mean		−29·64
V_a	+18·58	
V_d		− ·04
Curvature		− ·28
Radial velocity		−11·4

θ AQUILÆ 1605.

1908. June 12. G. M. T. $20^h 15^m$

Observed by / Measured by } T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
2	72·9907	....	....	....	2	53·0714	....	....	....
½	72·8128	·8345	·0303	−43·96	2	45·2430	....	....	....
2	72·4181	....	....	....	1	45·1817	·2124	·0263	−27·45
2	57·7935	....	....	....	2	43·5027	....	....	....
1	57·7576	·7934	·0334	−40·21	1	27·3562	·3619	·0507	−44·00
1	56·6375	....	....	....	2	27·2410	....	....	....
2	54·7059	....	....	....	1	11·7999	·7969	·0545	−41·56
1	53·9117	·9500	·0198	−22·78	2	11·5103	....	....	....

Weighted mean....................		−32·99
V_a....................	+18·58	
V_d....................		− ·04
Curvature....................		− ·28
Radial velocity....................		−14·7

θ AQUILÆ 1626.

1908. June 22. G. M. T. $18^h 35^m$

Observed by T. H. PARKER.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
1	57·8274	....	....	....	½	37·7445	·7260	·0287	−27·67
½	57·7977	·7957	·0311	−37·44	½	29·7998	·7680	·0629	−55·92
2	54·7455	....	....	....	2	29·6306	....	....	....
2	53·9400	·9377	·0321	−36·95	1	27·3906	·3481	·0645	−55·98
2	53·1130	....	....	....	2	27·2891	....	....	....
2	45·2851	....	....	....	2	11·8445	.7902	·0612	−58·39
1½	45·2209	·2094	·0293	−30·60	2	11·5615	....	....	....
2	37·9777	....	....	....					

Weighted mean....................		−44·13
V_a....................	+15·01	
V_d....................	+ ·04	
Curvature....................		− ·28
Radial velocity....................		−29·0

θ AQUILÆ 1626.*

1908. June 22.
G. M. T. $18^h\ 35^m$

Observed by T. H. Parker.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
1	57·8369	....	....	....	½	37·7667	·7262	·0383	−36·92
½	57·8165	·8025	·0243	−29·26	½	29·8124	·7624	·0685	−60·90
2	54·7682	....	....	....	2	29·6441	....	....	....
2	53·9534	·9294	·0404	−46·50	1	27·4266	·3746	·0380	−32·98
2	53·1347	....	....	....	2	27·3062	....	....	....
2	45·3077	....	....	....	2	11·8604	·7864	·0650	−48·68
1½	45·2463	·2123	·0264	−27·56	2	11·5823	....	....	....
2	38·9962	....	....	....					

Weighted mean..................		−41·03
V_a..............	+15·01	
V_d..............	+ ·04	
Curvature..............		− ·28
Radial velocity..............		−26·3

*Check measurement.

θ AQUILÆ 1634.

1908. June 24.
G. M. T. $19^h\ 46^m$

Observed by, Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
2	57·9245	....	....	....	1	37·8255	·7200	·0347	−33·45
½	57·8639	·7688	·0580	−69·83	2	30·0385	....	....	....
2	54·8405	....	....	....	1	29·8974	·7819	·0490	−43·56
3	54·0327	·9347	·0351	−40·40	1½	27·4733	·3561	·0565	−49·04
2	53·2094	....	....	....	2	27·3638	....	....	....
2	45·3719	....	....	....	2½	11·9231	·8011	·0503	−37·67
2	45·2924	·1941	·0446	−46·56	2	11·6292	....	....	....
2	38·0650	....	....	....					

Weighted mean..................		−42·95
V_a..............	+14·12	
V_d..............		− ·06
Curvature..............		− ·28
Radial velocity..............		−29·2

θ AQUILÆ 1643.

1908. June 26.
G. M. T. $19^h\ 42^m$

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
2	57·8751	....	....	....	2	38·0110	....	....	....
2	57·8285	·7742	·0526	−63·33	2	37·7647	·7131	·0416	−40·10
2	54·7850	....	....	....	1	27·4172	·3588	·0538	−46·70
2	53·9798	·9370	·0328	−37·75	2	27·3150	....	....	....
2	53·1545	....	....	....	3	11·8629	·8040	·0474	−35·50
2	45·3226	....	....	....	2	11·5661	....	....	....
2	45·2498	·2008	·0379	−39·57					

Weighted mean....................		−42·90
V_a	+13·22	
V_d		− ·09
Curvature..................		− ·28
Radial velocity...		−30·0

θ AQUILÆ 1651.

1908. June 27.
G. M. T. $18^h\ 45^m$

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
2	57·8640	....	....	....	1	30·8717	·8126	·0630	−56·57
1	57·8292	·7946	·0322	−38·77	2	29·6583	....	....	....
2	54·7825	....	....	....	1	29·6105	·5510	·0479	−42·53
2½	53·9715	·9320	·0378	−43·51	1½	27·4256	·3590	·0536	−46·52
2	53·1535	....	....	....	2	27·3135	....	....	....
2	45·3175	....	....	....	1½	15·4903	·4182	·0551	−42·65
1½	45·2365	·1926	·0461	−48·13	2	15·4707	....	....	....
2	38·0075	....	....	....	3	11·8646	·7958	·0556	−41·64
1	37·7459	·6973	·0554	−53·40	2	11·5760	....	....	....
2	30·9295	....	....	....					

Weighted mean....................		−45·06
V_a	+12·83	
V_d		·00
Curvature..................		− ·28
Radial velocity.............		−32·5

θ AQUILÆ 1659.

1908, July 3.
G. M. T. 17^h 30^m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
2	54·6001	....	....	....	2	11·6263	11·7883	·0631	−47·26
2	53·7884	53·9309	·0389	−44·77	2	11·3448	....	....	....
2	52·9687	....	....	....					

Weighted mean..................		−46·01
V_a..................	+10·32	
V_d..................		·00
Curvature..................		− ·18
Radial velocity..................		−35·9

θ AQUILÆ 1679.

1908, July 8.
G. M. T. 18^h 49^m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
1	73·1291	....	....	....	2	45·3990	....	....	....
1	72·9478	·8298	·0350	−50·78	1	45·3177	·1923	·0464	−48·44
1	72·5626	....	....	....	1	27·4959	·3539	·0587	−50·95
2	54·8610	....	....	....	2	27·3903	....	....	....
2	54·0581	·9390	·0308	−35·45	1½	11·9333	·7803	·0711	−53·25
2	53·2311	....	....	....	2	11·6602	....	....	....

Weighted mean..................		−46·30
V_a..................	+8·05	
V_d..................		− ·09
Curvature..................		− ·28
Radial velocity..................		−38·6

θ AQUILÆ 1691.

1908. July 10.
G. M. T. 19^h 30^m

Observed by } T. H. Parker.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9970	....	....	....	1½	53·9308	·9368	·0330	−37·98
½	72·8227	·8352	·0296	−42·94	2	53·1036	....	....	....
2	72·4327	....	....	....	2	45·2729	....	....	....
2	57·7960	....	....	....	½	45·1767	·1777	·0610	−63·68
1	57·7501	·7831	·0463	−55·74	½	27·3741	·3471	·0655	−56·85
2	56·6372	....	....	....	2	27·2739	....	....	....
2	54·7314	....	....	....					

Weighted mean..................		−48·88
V_a..................	+7·14	
V_d..................		− ·12
Curvature..................		− ·28
Radial velocity..................		−42·1

θ AQUILÆ 1691*.

1908. July 10.
G. M. T. 19h 30m

Observed by T. H. PARKER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions	Velocity.
1	73·0001	....	....	....	1½	53·9446	·9446	·0252	−29·00
½	72·8210	·8277	·0371	−53·83	2	53·1121	....	....	....
1	72·4443	....	....	....	2	45·2831	....	....	....
2	57·8282	....	....	....	1½	45·1971	·1874	·0513	−53·56
1	57·7688	·7700	·0568	−68·39	½	27·4088	·3658	·0468	−39·62
2	54·7417	....	....	....	2	27·2902	....	....	....

Weighted mean........................		−47·79
V_a........................	+7·14	
V_d........................		− ·12
Curvature........................		− ·28
Radial velocity........................		−41·0

* Check measurement.

θ AQUILÆ 1696.

1908. July 11.
G. M. T. 19h 10m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8543	....	....	....	1½	45·2351	·1991	·0396	−41·34
1	57·8215	·7968	·0300	−36·12	2	29·6333	....	....	....
2	54·7744	....	....	....	1	29·6020	·5676	·0313	−27·54
2	53·9587	·9274	·0424	−48·80	2	11·8235	·7982	·0532	−39·85
2	53·1422	....	....	....	2	11·5325	....	....	....
2	45·3096	....	....	....					

Weighted mean........................		−40·40
V_a........................	+6·60	
V_d........................		− ·12
Curvature........................		− ·28
Radial velocity........................		−34·2

θ AQUILÆ 1704.

1908. July 13.
G. M. T. 19h 37m

Observed by T. H. PARKER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0441	....	....	....	2	53·1318	....	....	....
½	72·8608	·8565	·0083	−12·05	2	45·3027	....	....	....
1	72·4491	....	....	....	1	45·2546	·2156	·0231	−24·12
2	57·8483	....	....	....	½	27·4155	·3555	·0561	−48·69
½	57·8073	·7883	·0385	−46·35	2	27·3060	....	....	....
2	54·7666	....	....	....	1½	11·8718	·7958	·0556	−41·64
2	53·9556	·9296	·0402	−46·27	2	11·5838	....	....	....

Weighted mean........................		−38·78
V_a	+5·77	
V_d		− ·16
Curvature........................		− ·28
Radial velocity........................		−33·5

θ AQUILÆ 1708.

1908, July 14.
G. M. T. 18h 19m

Observed by W. E. HARPER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0051	....	....	....	2	45·2705	....	....	....
1	72·8307	·8351	·0297	−43·09	2	45·2015	·2045	·0342	−35·70
1	72·4410	....	....	....	1½	27·3918	·3786	·0430	−37·32
2	54·7316	....	....	....	2	27·2622	....	....	....
2	53·9435	·9505	·0193	−22·21	2	11·8489	·8199	·0315	−23·58
2	53·1072	....	....	....	2	11·5364	....	....	....

Weighted mean........................		−30·83
V_a	+5·34	
V_d		·00
Curvature........................		− ·28
Radial velocity........................		−25·8

θ AQUILÆ 1716.

1908, July 15.
G. M. T. $19^h\ 24^m$

Observed by W. E. HARPER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0426				2	45·3046			
½	72·8798	·8475	·0173	−25·10	1	45·2469	·2159	·0228	23·80
1	72·4764				2	29·6384			
	57·8582				1½	29·6106	·5716	·0273	24·22
	57·8243	·7943	·0313	37·68	1½	27·4356	·3871	·0255	22·15
2	54·7774				2	27·2951			
2	53·9873	·9543	·0155	17·84	1½	11·8697	·8197	·0317	−23·74
2	53·1427				2	11·5523			

Weighted mean		−23·88
V_a	+4·86	
V_d		− ·16
Curvature		− ·28
Radial velocity		−19·5

θ AQUILÆ 1727.

1908, July 25.
G. M. T. $16^h\ 29^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0229				2	45·2811			
1	72·8498	·8385	·0263	−38·16	2	45·2157	·2082	·0305	31·84
1	72·4507				½	27·3982	·3715	·0411	35·67
2	54·7506				2	27·2733			
2	53·9420	·9323	·0375	43·16	2½	11·8282	·8011	·0503	−37·67
2	53·1227				2	11·5343			

Weighted mean		−37·52
V_a	+ ·25	
V_d	+ ·04	
Curvature		− ·28
Radial velocity		−37·5

θ AQUILÆ 1730.

1908, July 26.
G. M. T. 17h 38m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0205	....	....	....	2	45·2945	....	....	....
½	72·8350	·8244	·0404	−58·62	1½	45·2203	·1994	·0393	41·02
2	72·4551	....	....	....	1	27·4096	·3642	·0484	42·01
2	57·8380	....	....	....	2	27·2920	....	....	....
2	54·7570	....	....	....	2	11·8572	·8032	·0482	−36·10
2	53·9564	·9427	·0271	31·19	2	11·5612	....	....	....
2	53·1243	....	....	....					

Weighted mean	....	−38·20
V_a	....	− ·24
V_d	....	− ·11
Curvature	....	− ·28
Radial velocity	....	−38·8

θ AQUILÆ 1731.

1908. July 26.
G. M. T. 18h 07m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8287	....	....	....	1½	45·1997	·1980	·0407	42·49
½	57·7975	·7982	·0286	−41·50	½	27·3970	·3792	·0334	29·00
2	54·7409	....	....	....	2	27·2644	....	....	....
2	53·9365	·9368	·0330	38·00	½	11·8173	·7869	·0645	−48·31
2	53·1122	....	....	....	2	11·5376	....	....	....
2	45·2753	....	....	....					

Weighted mean	....	−39·83
V_a	....	− ·24
V_d	....	− ·11
Curvature	....	− ·28
Radial velocity	....	−40·5

θ AQUILÆ 1732.

1908. July 27. Observed by J. S. PLASKETT.
G. M. T. 18ʰ 15ᵐ Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·6860	...	...	...	1	45 0540	·2035	·0352	36·75
¼	57·6422	·7856	·0412	−49·60	2	29·4545	...	...	...
2	54·5924	...	...	...	1½	29·4224	·5668	·0321	28·47
2	53·7915	·9405	·0293	33·72	¼	11·6850	·8415	·0099	−7·41
2	52·9636	...	...	...	2	11·3507	...	...	...
2	45 1239	...	...	...		...			

Weighted mean	−32·23
V_a	− ·73
V_d	− ·12
Curvature	− ·28
Radial velocity	−33·4

θ AQUILÆ 1733.

1908. July 27. Observed by T. H. PARKER.
G. M. T. 20ʰ 10ᵐ Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8173	...	...	...	1	53·9094	·9241	·0457	−52·60
2	57·7872	·7993	·0273	−32·87	2	53·1007	...	...	...
2	54·7239	...	...	...					

Weighted mean	−39·45
V_a	− ·73
V_d	− ·24
Curvature	− ·28
Radial velocity	−40·7

θ AQUILÆ 1735.

1908. July 28. Observed by } W. E. HARPER.
G. M. T. 17ʰ 49ᵐ Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·7810	...	...	...	2	37·9067	...	...	...
1	57·7302	·7786	·0482	−57·91	½	37·6760	·7285	·0262	25·26
2	54 6993	...	...	...	2	29·5479	...	...	...
2	53·8959	·9391	·0307	35·33	1	29·4960	·5470	·0519	46·14
2	53·0681	...	...	...	½	27·3178	·3688	·0438	−38·02
2	45·2233	...	...	...	2	27·1956	...	...	...
1	45·1554	·2057	·0330	34·45					

Weighted mean	−40·13
V_a	− 1·20
V_d	− ·10
Curvature	− ·28
Radial velocity	−42·7

θ AQUILÆ 1736.

1908. July 28.
G. M. T. 18h 08m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7038	....	....	....	2	37·9039	....	....	....
1½	53·9012	·9418	·0280	−32·23	½	37·6815	·7368	·0179	−17 25
2	53·0684	....	....	....					

Weighted mean....................	−28·48
V_a....................	− 1·20
V_d....................	− ·12
Curvature....................	− ·28
Radial velocity....................	−30·1

θ AQUILÆ 1747.

1908. July 30.
G. M. T. 17h 47m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0586	....	....	....	2	45·2720	....	....	....
½	72·8916	·8438	·0210	−30·47	1½	45·1954	·1970	0417	43·53
2	72·4899	....	....	....	½	27·3662	3783	·0343	29·77
2	54·7537	....	....	....	2	27·2345	....	....	....
2	53·9640	·9538	0160	18·42	½	11·7805	8237	0287	−21·50
2	53·1210	....	....	....	2	11·4640	....	....	....

Weighted mean....................	−28·60
V_a....................	− 2·13
V_d....................	− ·10
Curvature....................	− ·28
Radial velocity....................	−31·1

θ AQUILÆ 1755.

1908. July 31.
G. M. T. 17h 52m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·9005	....	....	....	2	29·6870	....	....	....
1	57·8680	·7968	·0300	−36·12	1	27·4678	·3771	·0355	30·81
2	45·3421	....	....	....	2	27·3373	....	....	....
1	45 2829	·2144	·0243	25·37	1	11·8987	·8159	·0355	−26·59
1½	29·6625	·5744	·0245	21·78	2	11·5900	....	....	....

Weighted mean....................	−27·56
V_a....................	− 2·59
V_d....................	− ·11
Curvature....................	− ·28
Radial velocity....................	−30·5

θ AQUILÆ 1756.

1908. July 31.
G. M. T. 18^h 19^m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·1090	....	....	....	2	45·3718	....	....	....
½	72·9433	·8464	·0184	−26·70	2	45·3132	·2150	·0237	24·74
2	72·5395	....	....	....	1½	27·5107	·3881	·0245	21·27
2	54·8279	....	....	....	2	27·3692	....	....	....
1½	54·0425	·9526	·0172	19·80	2	11·9418	·8239	·0275	−20·60
2	53·2057	....	....	....	2	11·6251	....	....	....

Weighted mean.................... −23·42
V_a .... − 2·59
V_d .... − ·15
Curvature................. − 28

Radial velocity .... −26·4

θ AQUILÆ 1762.

1908. Aug. 5.
G. M. T. 14^h 50^m

Observed by J. S. PLASKETT.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0445	....	....	....	2	37·9735	....	....	....
½	72·9019	·8689	·0041	+ 5·94	½	37·8169	·8026	·0479	46·17
2	72·4763	....	....	....	½	30·9439	·9214	·0458	41·12
2	54·7639	....	....	....	2	30·8932	....	....	....
1	54·0333	·0153	·0455	52·37	1	27·4672	·4477	·0351	30·46
2	54·0467	....	....	....	2	27·2659	....	....	....
2	53·1283	....	....	....	1	11·9221	·9161	·0647	+48·46
2	45·2915	....	....	....	2	11·5123	....	....	....
1½	45·2840	·2661	·0274	28·60					

Weighted mean.................... +39·69
V_a .... − 4·91
V_d .... + ·09
Curvature........ − ·28

Radial velocity................. +34·6

θ AQUILÆ 1766.

1908. Aug. 5.
G. M. T. 16h 29m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7555	....	....	....	2	37·9696	....	....	....
1½	54·0175	0058	·0360	+41·44	1	37·8146	·8042	·0495	47·72
2	53·1220	....	....	....	2	11·9212	·9096	·0582	+43·59
2	45·2833	....	....	....	2	11·5188	....	....	....
1½	45·2691	·2594	·0207	21·61					

Weighted mean.................... +38·25
V_a.................... − 4·91
V_d.................... − ·02
Curvature.................... − ·28

Radial velocity.................... +33·0

θ AQUILÆ 1767.

1908. Aug. 5.
G. M. T. 17h 18m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7650	....	....	....	1	37·7837	·7738	·0191	16·98
1	54·0152	·9958	·0260	+29·93	½	27·4480	·4226	·0100	8·68
2	53·1277	....	....	....	2	27·2720	....	....	....
2	45·2725	·2545	·0158	16·50	½	11·9180	·8968	·0454	+34·00
2	45·2916	....	....	....	2	11·5284	....	....	....
2	37·9791	....	....	....					

Weighted mean.................... +21·19
V_a.................... − 4·91
V_d.................... − ·09
Curvature.................... − ·28

Radial velocity.................... +15·9

θ AQUILÆ 1769.

1908. Aug. 5.
G. M. T. 18h 48m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0800	....	....	....	2	54·0263	·9743	·0045	+ 5·18
½	72·9310	·8618	·0030	− 4·35	2	53·1625	....	....	....
2	72·5112	....	....	....	2	45·3224	....	....	....
2	54·7953	....	....	....	1	45·2968	·2476	·0089	+ 9·29

Weighted mean.................... + 5·00
V_a.................... − 4·91
V_d.................... − ·19
Curvature.................... − ·28

Radial velocity.................... − 0·4

θ AQUILÆ 1776.

1908, Aug. 7.
G. M. T. 17^h

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0105				2	53·1270			
½	72·8287	·8311	·0337	−48·90	2	45·2947			
2	72·4393				1	45·2207	·1994	·0393	41·03
2	54·7527				2	11·8727	·8100	·0414	−30·64
1½	53·9542	9413	·0285	32·80	2	11·5703			

Weighted mean.................. −35·19
V_a .... − 5·87
V_d .... − ·08
Curvature.................. − ·28

Radial velocity.................. −41·4

θ AQUILÆ 1777.

1908. Aug. 7.
G. M. T. 17^h 45^m

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0173				2	45·3157			
½	72·8345	·8281	·0367	−53·25	1	45·2536	·2117	·0270	28·19
2	72·4482				1	27·4414	·3756	·0370	32·12
2	57·8521				2	27·3125			
1	57·8257	·8028	·0240	28·90	1½	11·9090	8208	·0306	22·64
2	54·7686				2	11·5960			
1½	53·9666	·9371	·0327	37·64	1	29·8450	·7881	·0428	−38·05
2	53·1442				2	29·6558			

Weighted mean.................. −32·57
V_a .... − 5·87
V_d .... − ·14
Curvature.................. − ·28

Radial velocity.................. −38·9

θ AQUILÆ 1789.

1908. Aug. 17.
G. M. T. 18^h 18^m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	57·8885	·8148	·0120	−13·81	2	45·3395			
2	57·9031				1	45·2972	·2313	·0074	7·72
2	54·8125				2	38·0187			
2	54·0320	·9614	·0084	9·67	1	37·8079	·7484	·0063	− 6·07
2	53·1826								

Weighted mean.................. − 9·78
V_a .... −10·39
V_d .... − ·21
Curvature.................. − ·28

Radial velocity.................. −20·7

θ AQUILÆ 1789.*

1908. Aug. 17.
G. M. T. 18h 18m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8769	......	......	......	1	45·2667	·2271	·0116	12·11
1	57·8580	·8105	·0163	−20·15	2	37·9966	......	......	......
2	54·7899	......	......	......	1	37·7900	·7526	·0021	2·02
2½	54·0078	·9618	·0080	9·21	½	29·8666	·8260	·0049	−4·36
2	53·1557	......	......	......	2	29·6395	......	......	......
2	45·3130	......	......	......					

Weighted mean .... − 9·91
V_a .... −10·39
V_d .... − ·21
Curvature .... − ·28

Radial velocity .... −20·8

* Inadvertently remeasured.

θ AQUILÆ 1794*.

1908. Aug. 19.
G. M. T. 16h 45m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	111·6998	......	......	......	2	68·7143	......	......	......
½	111·3210	·1330	·0193	−11·19	2	63·3902	......	......	......
2	110·2983	......	......	......	4	61·2072	·2159	·0286	11·75
2	71·8920	......	......	......	2	60·3880	......	......	......
1	71·8568	·8664	·0392	17·29	2	36·0921	......	......	......
½	69·5153	·5373	·0155	6·73	½	35·9450	·9631	·0427	−14·90

Weighted mean .... −12·41
V_a .... −11·21
V_d .... − ·12
Curvature .... − ·28

Radial velocity .... −24·0

* Plate made with three-prism spectrograph.

θ AQUILÆ 1799.

1908. Aug. 20.
G. M. T. $15^h\ 15^m$

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9899	...	...	...	2	45·2480	·2644	·0257	+26·83
½	72·8610	·8811	·0163	+23·65	2	37·9470	...	...	...
2	72·4241	...	...	...	1	37.7533	·7655	·0108	+10·41
2	57·8022	...	...	...	1	29·6165	·6164	·0175	+15·56
1	57·8095	·8387	·0119	+14·33	2	29.5990	...	...	...
2	54·7204	...	...	...	½	27·4145	·4051	·0075	− 6·51
2	53·9533	·9751	·0053	+ 6·11	2	27·2560	...	...	...
2	53·0898	...	...	...	?½	11·8457	·8229	·0185	−13·90
2	45·2572	...	...	...	2	11·5300	...	...	...

Weighted mean.................. +12·45
V_a .... −11·63
V_d .... ·00
Curvature .... − ·28

Radial velocity.................... + 0·4

θ AQUILÆ 1800.

1908. Aug. 20.
G. M. T. $15^h\ 47^m$

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0033	...	...	...	1½	45·2531	·2537	·0150	+15·66
½	72·8582	·8648	·0000	0·00	1	27·4586	·4290	·0164	+14·23
2	72·4383	...	...	...	2	27·2762	...	...	...
2	54·7375	...	...	...	2	11·9005	·8700	·0186	+13·93
1	53·9710	·9747	·0049	+ 5·64	1	59·8045	...	...	...
2	53·1090	...	...	...	1	59·6690	·6736	·0009	− 1·23
2	45·2729	...	...	...					

Weighted mean.............. +10·00
V_a .... −11·63
V_d .... − ·05
Curvature .... − ·28

Radial velocity............ − 2·0

θ AQUILÆ 1801.

1908. Aug. 20.
G. M. T. 16^h 42^m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7354	....	....	....	1	29·6294	·6194	·0205	18·24
2	53·9787	·9881	·0183	+21·06	2	29·6095	....	....	....
2	53·0997	....	....	....	1	27·4557	·4361	·0235	20.39
2	45·2665	....	....	....	2	27·2662	....	....	....
1½	45·2453	·2524	·0137	14·30	½	11·8902	·8614	·0100	+ 7·49
2	29·9322	....	....	....	2	11·5362	....	....	....
1	29·8670	·8575	·0266	23·67					

Weighted mean		+18·52
V_a	−11·63	
V_d	− ·12	
Curvature	− ·28	
Radial velocity		+ 6·5

θ AQUILÆ 1807.

1908. Aug. 21.
G. M. T. 13^h 57^m

Observed by J. B. CANNON.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0196	....	....	....	¾	45·3011	·2689	·0302	31·52
¼	72·9000	·8880	·0232	+33·66	2	29·6480	....	....	....
2	72·4635	....	....	....	1	29 9315	·8830	·0521	46·32
2	54·7685	....	....	....	?¼	27·4940	·4406	·0280	24·30
1½	54·0400	·0124	·0426	49 03	2	27·3002	....	....	....
2	53·1406	....	....	....	?¼	11 9607	·8964	·0410	+30·71
2	45·3058	....	....	....	2	11·5717	....	....	....

Weighted mean		+41·42
V_a	−12·04	
V_d	− ·11	
Curvature	− ·28	
Radial velocity		+28·7

θ AQUILÆ 1808.

1908. Aug. 21.
G. M. T. $14^h\ 32^m$

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9966	....	....	....	2	45·2823	....	....	....
½	72·8700	·8818	·0170	+24·67	1	45·2779	·2692	·0305	31·84
2	72·4343	....	....	....	2	37·9791	....	....	....
?½	57·8783	·8783	·0515	62·00	1	37·8077	·7978	·0431	41·55
2	57·8294	....	....	....	½	27·4542	·4226	·0100	8·68
2	54·7475	....	....	....	2	27·2782	....	....	....
1½	54·0150	·0110	·0412	47·42	1	11·9453	·9014	·0500	+37·45
2	53·1145	....	....	....	2	11·5512	....	....	....

Weighted mean..........................		+38·27
V_a..........................	−12·04	
V_d..........................		+ ·06
Curvature..........................	− ·28	
Radial velocity..........................		+26·0

θ AQUILÆ 1810.

1908. Aug. 21.
G. M. T. $15^h\ 28^m$

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7201	....	....	....	2	29·5981	....	....	....
3	53·9840	·0054	·0356	+40·97	?½	27·4505	·4459	·0333	28·90
2	53·0910	....	....	....	2	27·2512	....	....	....
2	45·2620	....	....	....	½	11·8967	·8831	·0317	+23·74
2	45·2523	·2659	·0272	28·40	2	11·5218	....	....	....
½	29·8745	·8753	·0444	39·47					

Weighted mean..........................		+34·73
V_a..........................	−12·04	
V_d..........................	− ·02	
Curvature..........................	− ·28	
Radial velocity..........................		+22·4

θ AQUILÆ 1811.

1908. Aug. 22.
G. M. T. 15^h 29^m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9587	....	....	....	2	45·2600	....	....	....
½	72·8387	·8901	·0253	+36·71	1	45·2775	·2911	·0524	54·70
2	72·3930	....	....	....	1	27·4871	·4580	·0454	39·43
2	54·7138	....	....	....	2	27·2762	....	....	....
2	53·9876	·0134	·0436	50·18	2	11·9679	·9170	·0656	+49·13
2	53·0885	....	....	....	2	11·5587	....	....	....

Weighted mean........................		+47·86
V_a................	−12·50	
V_d................	− ·03	
Curvature..............	− ·28	
Radial velocity........................		+35·0

θ AQUILÆ 1812.

1908. Aug. 22.
G. M. T. 15^h 56^m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9892	....	....	....	2	45·2531	....	....	....
½	72·8897	·9116	·0468	+67·91	1	45·2633	·2838	·0451	47·08
2	72·4190	....	....	....	¾	27·5378	·4728	·0602	52·25
2	54·7430	....	....	....	2	27·3121	....	....	....
1	54·0200	·0182	·0484	55·71	2	12·0073	·9163	·0649	+48·61
2	53·1145	....	....	....	2	11·5988	....	....	....

Weighted mean........................		+52·03
V_a................	−12·50	
V_d................	− ·08	
Curvature..............	− ·28	
Radial velocity........................		+39·1

θ AQUILÆ 1813.

1908. Aug. 22.
G. M. T. $16^h\ 21^m$

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9817	....	....	....	2	45·2804	....	....	....
½	72·8487	·8779	·0131	+19·01	1	45·2807	·2739	·0352	36·75
2	72·4145	....	....	....	½	29·7215	·6886	·0897	79·74
½	57·8665	·8839	·0571	68·75	2	29·6318	....	....	....
2	57·8120	....	....	....	½	27·4825	·4387	·0221	19·18
2	54·7342	....	....	....	2	27·2904	....	....	....
1	54·0030	·0118	·0420	48·34	2½	11·9879	·9218	·0704	+52·73
2	53·1022	....	....	....	2	11·5733	....	....	....

Weighted mean......................		+47·73
V_a..............	−12·50	
V_d..............	− ·11	
Curvature	− ·28	
Radial velocity............		+34·8

θ AQUILÆ 1814.

1908. Aug. 23.
G. M. T. $15^h\ 48^m$

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0102	....	....	....	2	53·1312	....	....	....
½	72·8535	·8541	·0103	−14·94	2	45·3009	....	....	....
2	72·4415	....	....	....	1	45·2574	·2301	·0086	8·98
2	57·8425	....	....	....	1	27·4527	·3856	·0270	23·44
1	57·8224	·8093	·0175	21·07	2	27 3137	....	....	....
2	54·7607	....	....	....	2	11·9226	·8286	·0228	−17·08
2	53·9771	·9581	·0117	13·47	2	11·6012	....	....	....

Weighted mean......................	−16·27
V_a..................	−12·95
V_d........	− ·08
Curvature....	− ·28
Radial velocity....	−29·6

θ AQUILÆ 1815.

1908. Aug. 23.
G. M. T. $16^h\ 18^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0307				1½	45·2666	·2192	·0195	20·36
½	72·8645	·8438	·0210	30·47	2	38·0157			
2	72·4655				½	37·7910	·7348	·0199	19·18
2	57·8525				½	29·6320	·5663	·0336	29·87
1½	57·8167	·7936	·0332	39·97	2	29·6646			
2	54·7766				?½	27·4726	·4035	·0091	7·90
1½	54·0057	·9686	·0012	1·38	2	27·3157			
2	53·1516				2	11·9125	·8329	·0185	−13·86
2	45·3210				2	11·5870			

Weighted mean .... −19·30
V_a .... −12·95
V_d .... − ·10
Curvature .... − ·28

Radial velocity .... −32·6

θ AQUILÆ 1822.

1908. Aug. 24.
G. M. T. $16^h\ 51^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0206				3	45·2872			
1	72·8615	·8505	·0143	−20·75	1½	45·2305	·2169	·0218	22·76
2	72·4567				2	37·9830			
2	57·8371				1	37·7598	·7360	·0187	18·03
1	57·8167	·8090	·0178	21·43	1	27·4280	·3884	·0232	20·14
2	54·7477				2	27·2862			
2	53·9567	·9471	·0227	26·13	2½	11·8689	·8272	·0242	−18·12
2	53·1254				2	11·5489			

Weighted mean .... −21·20
V_a .... −13·40
V_d .... − ·16
Curvature .... − ·28

Radial velocity .... −35·0

θ AQUILÆ 1835.

1908. Aug. 27.
G. M. T. 14^h 02^m

Observed by } J. B. CANNON.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0129	....	....	....	2	45·2808	....	....	....
½	72·8466	·8451	·0197	−28·58	1½	45·2153	·2081	·0306	31·95
1	72·4418	....	....	....	1	27·3961	·3662	·0536	45·42
2	54·7388	....	....	....	2	27·2768	....	....	....
1	53·9403	·9413	·0285	32·80	1	11·8524	·8125	·0389	−29·14
2	53·1131	....	....	....	2	11·5472	....	....	....

Weighted mean............	−33·92	
V_a	−14·56	
V_d	....	+ ·06
Curvature ...	− ·28	
Radial velocity........	−48 8	

θ AQUILÆ 1864.

1908. Sept. 3.
G. M. T. 16^h 17^m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0322	....	....	....	1½	45·2772	·2317	·0070	7·33
1	72·8740	·8526	·0122	−17·73	2	29·9972	....	....	....
2	72·4635	....	....	....	1½	29·8930	·8174	·0135	12·08
2	57·8686	....	....	....	1	29·6557	·5860	·0129	11·49
½	57·8351	·7959	·0309	37·26	2	29·6787	....	....	....
2	54·7801	....	....	....	1	27·4700	·3816	·0310	27·03
2½	54·0005	·9616	·0082	9·46	2	27·3355	....	....	....
2	53·1516	....	....	....	1½	11·9352	·8254	·0260	−19·58
2	45·3191	....	....	....	2	11·6205	....	....	....

Weighted mean..................	−14·96
V_a	−17·37
V_d	− ·16
Curvature..............	− ·28
Radial velocity...............	−32·8

θ AQUILÆ 1864.*

1908. Sept. 3. G. M. T. 16ʰ 17ᵐ

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9854				2	45·2737			
½	72·8295	·8541	·0107	−15·52	1	45·2348	·2347	·0040	4·16
2	72·4198				½	29·8500	·8107	·0202	17·80
2	57·8199				2	30·9097			
½	57·8027	·8122	·0172	20·70	1	29·6055	·5660	·0181	16·05
2	54·7376				1	11·8883	·8258	·0256	−19·17
1½	53·9573	·9618	·0080	9·20	2	11·5697			
2	53·1065								

Weighted mean	−15·34
V_a	−17·37
V_d	− ·16
Curvature	− ·28
Radial velocity	−33·1

* Independent measurement.

θ AQUILÆ 1875.

1908. Sept. 8. G. M. T. 12ʰ 42ᵐ

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0022				2	45·2770			
½	72·8789	·8850	·0202	+29·31	1½	45·3101	·3067	·0680	70·99
1	72·4437				1	27·5014	·4694	·0568	49·34
2	54·7440				2	27·2778			
1	54·0395	·0356	·0658	75·73	1	12·0038	·9496	·0982	+73·55
2	53·1178				2	11·5614			

Weighted mean		+67·85
V_a	−17·08	
V_d		+ ·09
Curvature	− ·28	
Radial velocity		+50·6

θ AQUILÆ 1875*.

1908. Sept. 8.
G. M. T. $12^h\ 42^m$

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7676	....	....	....	2	29·6453	....	....	....
2	54·0485	·0218	·0520	+59·85	1½	29·7430	·6966	·0977	86·66
2	53·1396	....	....	....	1	12·0185	·9417	·0903	+67·63
2	45·3024	....	....	....	2	11·5840	....	....	....
1½	45·3295	·3007	·0620	64·73					

Weighted mean....................		+69·07
V_a	−17·08	
V_d		+ ·09
Curvature.....	− ·28	
Radial velocity..................		+51·8

* Check measurement.

θ AQUILÆ 1876.

1908. Sept. 8.
G. M. T. $13^h\ 40^m$

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0136	....	....	....	1½	45·3045	·3014	·0627	65·45
½	72·9175	·9105	·0457	+66·31	1	27·5001	·4706	·0580	50·34
2	72·4645	....	....	....	2	27·2761	....	....	....
2	54·7428	....	....	....	1½	11·9869	·9574	·1060	+79·39
1½	54·0359	·0350	·0652	75·04	2	11·5444	....	....	....
2	45·2767	....	....	....					

Weighted mean....................		+68·88
V_a	−17·08	
V_d	·00	
Curvature.....	− ·28	
Radial velocity..................		+51·5

θ AQUILÆ 1878.

1908. Sept. 11.
G. M. T. 15^h

Observed by J. B. Cannon.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0192	....	....	....	2	45·2692	....	....	....
½	72·8480	·8396	·0252	−36·56	1	45·2233	·2277	·0110	11·48
2	72·4503	....	....	....	1	27·3789	·3712	·0414	35·93
2	54·7399	....	....	....	2	27·2541	....	....	....
2	53·9497	·9515	·0183	21·06	1½	11·8400	·8283	·0231	−17·30
2	53·1104	....	....	....	2	11·5249	....	....	....

Weighted mean	−22·29
V_a	−20·21
V_d	− ·09
Curvature.....	− ·28
Radial velocity......	−47.7

P.—Plaskett.
H.—Harper.
C.—Cannon.
P¹—Parker.
T.—Tribble.

OBSERVING RECORD AND DETAILED MEASURES OF ε HERCULIS.

RECORD OF SPECTROGRAMS.

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure G. M. T.	Duration.	Hour Angle at end.	Temperature Centigrade. Room. Beginning.	Room. End.	Prism Box. Beginning.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1907.	h. m.	m.	h. m.								
ε Herculis..	786	II.	Seed 27 ..	May 24..	18 25	20	0 40 W.	8·5	9·5	16·4	16·4	·001	Fair......	P	
" ..	801	"	" .	" 31..	17 38	20	25 W.	12·7	12·6	18·8	18·8	·001	Good. ...	P	
" ..	810	"	" ..	June 8..	19 28	30	2 45 W.	13·0	13·0	16·9	16·8	·001	....	P	
" ..	816	"	" ..	" 10..	17 47	35	1 20 W.	13·1	12·8	17·9	17·9	·001	Good.....	P	
" .	827	"	" ..	" 11..	15 39	26	55 E.	15·6	15·5	19·1	19·1	·001	"	H	
" ..	838	"	" ..	" 12..	18 35	30	2 10 W.	15·4	15·2	19·0	18·9	·0012	Fair.....	P	
" ..	847	"	" ..	" 13..	18 25	10	1 55 W.	19·0	19·0	25·8	25·8	·0015	"	H	
" ..	851	"	" ..	" 14..	17 43	34	1 30 W.	20·5	19·8	23·1	23·1	·0012	Good.....	P	
" ..	862	"	" ..	" 20..	16 37	31	46 W.	21·5	21·0	25·4	25·4	·0012	"	H	
" ..	871	"	" ..	" 21..	18 10	35	2 25 W.	23·1	22·6	29·0	29·0	·001	....	P	
" ..	881	"	" ..	" 25..	16 04	28	30 W.	23·8	23·8	27·3	27·3	·0012	Good.....	H	
" ..	893	"	" ..	" 27..	16 32	35	1 10 W.	20·9	20·0	24·5	24·5	·0012	Fair......	H	
" ..	913	"	" ..	July 4..	16 18	40	1 25 W.	20·0	19·5	28·6	28·4	·0012	Poor. ...	H	
" ..	920	"	" ..	" 8..	16 00	35	1 30 W.	21·2	21·2	22·4	22·4	·0012	Fair......	P	
" ..	928	"	" ..	" 9 .	15 15	38	40 W.	22·2	22·2	24·8	24·8	·0012	Good.....	T	
" ..	937	"	" ..	" 10..	14 55	70	40 W.	24·5	23·6	24·7	24·6	·0012	Poor.	P	
" ..	952	"	" ..	" 18..	16 10	60	2 22 W.	22·5	22·5	28·5	28·3	·0014	Hazy	H	
" ..	957	"	" ..	" 20..	16 39	32	2 45 W.	18·6	18·8	21·5	21·5	·0012	Good.....	P	
" ..	976	"	" ..	Aug. 1..	17 20	50	4 24 W.	20·0	20·0	24·8	24·8	·0012	Very hazy	T	
" ..	979	"	" ..	" 3..	13 28	34	30 W.	20·8	20·3	24·1	24·0	·0012	... .	P	
" .	987	"	" .	" 6..	17 35	80	5 13 W.	19·4	18·0	23·3	23·3	·0013	Poor.....	T	
" ..	1018	"	" ..	" 22..	15 49	53	4 15 W.	18·5	18·0	24·2	24·2	·0014	Fair......	H	
" .	1062	"	" ..	Sept. 20..	14 37	45	4 54 W.	22·3	22·3	22·9	22·8	·0014	Poor.....	H	
				1908.											
" .	1391	"	" ..	Mar. 9..	20 50	60	1 31 E.	12·5	−13·0	1·0	1·0	·0013	....	H	
" ..	1403	"	" ..	" 16..	21 42	50	16 E.	−13·0	−13·5	2·3	2·3	·0014	Good.....	H	
" ..	1483	"	" ..	Apr. 13..	21 35	60	1 36 W.	−0·5	−1·5	8·0	8·0	·0018	Poor.....	H	

"	..	1494	"	" ..	" 15..	20	40	41		40 W.	− 3·6	− 2·6	7·6	7·6	·0015	Good.....	P
"	..	1511	"	" ..	" 22..	20	33	40	1	00 W.	5·2	3·5	12·5	12·6	·0017	"	P
"	..	1531	"	" ..	May 15..	19	29	48	1	28 W.	13·0	11·5	17·8	18·0	·0017	"	H
"	..	1540	"	" ..	" 18..	18	25	40		36 W.	16·6	16·5	23·4	23·4	·0016	Fair......	P¹
"	..	1545	"	" ..	" 20..	17	15	70		15 W.	18·0	16·9	21·0	21·0	·0016	St'dy,hazy	P
"	..	1547	"	" ..	" 22..	18	28	57		58 W.	20·0	20·0	25·0	25·0	·0017	Fair......	P¹H
"	..	1567	"	" ..	June 1..	19	30	40	2	45 W.	13·6	12·5	21·2	21·2	·0015	"	P¹
"	..	1573	"	" ..	" 3..	17	56	62	1	15 W,	14·2	13·7	18·3	18·3	·0015	"	P-H
"	..	1582	"	" ..	" 5.	18	40	60	2	15 W.	16·6	15·5	24·5	24·5	·0016	"	P¹
"	.	1603	"	" ..	" 12..	18	35	60	2	35 W.	17·0	15·7	24·9	24·9	·0017	Good.....	P¹
"	..	1625	"	" ..	" 22..	17	27	65	2	00 W.	18·0	17·6	23·8	23·8	·0015	"	P
"	..	1630	"	" ..	" 24..	16	27	45	1	00 W.	21·5	20·5	27·5	27·6	·0015	"	P
"	..	1640	"	" ..	" 26.	16	46	53	1	43 W.	20·0	17·7	30·0	30·0	·0016	"	H-C
"	..	1648	"	" ..	" 27..	17	07	55	2	00 W.	20·5	19·8	23·8	23·7	·0014	Fair......	P
"	..	1653	"	" ..	July 1..	16	15	80	1	30 W.	23·5	21·0	25·8	26·8	·0015	Cloudy. ..	P
"	..	1658	"	" ..	" 3..	16	18	69	1	40 W.	21·9	21·5	25·4	25·4	·0016	Good.....	H
"	..	1661	"	" ..	" 3..	19	40	60	5	05 W.	20·0	19·5	25·1	25·1	·0016	Hazy	P¹
"	..	1666	"	" ..	" 6..	17	35	60	3	00 W.	25·8	23·6	26·4	26·4	·0015	Good.....	P-P¹⁄₂
"	..	1675	"	" ..	" 8.	15	47	40	1	15 W.	19·0	18·0	21·8	21·6	·0015	"	C
"	..	1676	"	" ..	" 8..	16	32	45	2	05 W.	18·0	17·5	21·6	21·6	·0015	"	C
"	..	1682	"	" ..	" 9..	17	12	50	2	47 W.	20·0	19·7	21·5	21·5	·0015	"	H
"	..	1685	"	" ..	" 10..	14	37	60		22 W.	24·5	24·0	27·5	27·4	·0016	"	C
"	..	1686	"	" ..	" 10..	15	34	52	1	12 W.	24·0	22·5	27·4	27·3	·0016	"	H
"	..	1693		" ..	" 11..	16	58	53	2	45 W.	27·5	26·5	30·1	29·9	·0015	Fair......	P
"	..	1699	"	" ..	" 13..	16	19	52	2	15 W.	19·6	19·5	23·1	23·1	·0015	"	P
"	..	1707	"	" ..	" 14..	17	42	48	3	37 W.	20·5	20·0	20·6	20·6	·0016	Good....	H
"	..	1712	"	" ..	" 15..	17	00	40	2	55 W.	17·0	16·3	21·6	22·3	·0015	"	C
"	..	1713	"	" ..	" 15..	17	45	40	3	40 W.	16·3	15·0	22·3	22·0	·0015	"	H
"	..	1719	"	" ..	" 16..	17	25	43	3	26 W.	18·0	17·0	19·6	20·0	·0015	"	H
"	..	1720	"	" ..	" 22..	17	00	145	5	00 W.	22·6	21·0	24·7	24·7	·0015	Very poor	P-H
"	..	1723	"	" ..	" 24..	14	00	60		40 W.	24·0	23·0	26·3	26·2	·0016	Fair....	H
"	..	1728	"	" ..	" 25..	17	20	85	4	30 W.	20·6	20·5	24·6	24·5	·0015	Poor. ...	P
"	..	1729	"	" ..	" 26..	16	58	47	3	40 W.	23·0	22·0	23·6	23·6	·0015	Good.....	H
"	..	1734	"	" ..	" 28..	17	12	45	4	02 W.	24·0	25·0	29·8	29·8	·0016	"	H
"	..	1737	"	" ..	" 29..	14	22	55	1	20 W.	27·5	27·0	30·3	30·2	·0015	Hazy	P
"	..	1738	"	" ..	" 29..	15	08	30	1	53 W.	27·0	26·6	30·2	30·2	·0015	Fair......	P
"	..	1743	"	" ..	" 29..	18	05	60	4	58 W.	25·6	25·0	30·1	30·0	·0015	" ...	P-C
"	..	1746	"	" ..	" 30..	17	06	33	4	00 W.	27·0	26·0	31·1	31·1	·0015	"	H
"	..	1751	"	" ..	" 31..	15	40	39	2	40 W.	21·0	20·0	26·0	26·0	·0015	Good.....	P¹
"	.	1757	"	" ..	" 31..	19	05	60	6	14 W.	18·5	17·0	25·6	25·3	·0015	"	H
"	..	1760	"	" ..	Aug. 1..	16	49	82	4	15 W.	20·6	20·4	23·2	23·2	·0015	Fair......	P
"	..	1761	"	" ..	" 5..	14	05	50	1	30 W.	22·6	22·6	27·0	27·0	·0015	"	P
"	..	1774	"	" ..	" 7..	15	35	80	3	25 W.	20·2	19·1	23·6	23·6	·0015	Very hazy	P¹
"	..	1782	"	" ..	" 15..	16	50	50	4	50 W.	18·6	18·0	22·8	22·6	·0015	Fair......	P
"	..	1793	IIIL.	" ..	" 19..	14	41	98	3	17 W.	16·5	14·5	23·8	23·6	·002	"	H
"	..	1818	IL.	" ..	" 24..	14	03	52	2	45 W.	17·5	17·0	23·3	23·2	·0015	Good.....	H
"	..	1838	"	" ..	" 27..	15	50	45	4	36 W.	17·0	16·3	23·0	22·8	·0015	"	C
"	..	1844	"	" ..	" 28..	14	07	45	3	00 W.	18·5	17·0	23·2	23·2	·0015	"	C
"	..	1853	"	" ..	" 31..	13	52	46	2	55 W.	24·0	22·0	28·0	27·8	·0015	Fair	H
"	..	1866	"	" ..	Sept. 4..	14	32	56	3	53 W.	19·3	18·8	23·5	23·4	·0015	"	C

P.—Plaskett.
H.—Harper.
C.—Cannon.
P1—Parker.
T.—Tribble.

RECORD OF SPECTROGRAMS—*Concluded.*

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure G. M. T.		Duration.	Hour Angle at end.		Temperature Centigrade. Room. Beginning.	Room. End.	Prism Box. Beginning.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1908.	h.	m.	m.	h.	m.								
ϵHerculis...	1903	IL.	Seed 27...	Oct. 1..	13	12	60	4	30 W.	13·5	12·5	19·0	18·8	·0015	Bad.	H	
" ..	1905	"	" ..	" 2..	12	23	44	3	40 W.	9·2	8·0	13·2	13·1	·0015	Clear	P1	
" ..	1906	"	" ..	" 2..	13	18	44	4	60 W.	8·0	7·3	13·1	13·0	·0015	Good.....	P1	
" ..	1917	"	" ..	" 5 .	12	45	50	4	10 W.	9·7	8·5	14·5	14·5	·0015	Hazy	P1	
" ..	1926	"	" ..	" 12..	14	15	60	6	25 W.	5·9	5·5	6·6	7·2	·0016	Good.....	P1	
" ..	1961	"	" ..	Nov . 13..	10	33	53	4	32 W.	3·5	3·0	8·3	7·3	·0015	"	H	
" ..	1983	"	" ..	" 26..	10	07	45	4	52 W.	11·0	12·0	12·0	13·0	·0016	.....	H	
" ..	1993	"	" ..	Dec. 2..	11	05	57	6	15 W.	− 7·5	− 8·2	− 2·0	− 2·0	·0016	Windy. ..	C	
				1909.													
" ..	2263	"	" ..	Feb. 8..	22	08	45	2	12 E.	−19·0	−18·0	− 5·3	− 5·1	·0016	Fair	H	
" ..	2264	"	" ..	" 8..	23	00	56	1	15 E.	−18·0	−19·0	− 5·1	− 5·0	·0016	"	H	
" ..	2305	"	" ..	" 22..	21	34	62	1	45 E.	− 6·0	− 7·8	0·8	0·6	·0016	"	C	
" ..	2306	"	" ..	" 22..	22	36	60		43 E.	− 7·8	− 7·5	0·6	0·6	·0016	"	C	
" ..	2327	"	" ..	Mar. 3..	21	12	75	1	25 E.	− 5·8	− 6·4	− 0·6	− 0·7	·0016	"	C	
" ..	2328	"	" ..	" 3..	22	26	68		10 E.	− 6·4	− 6·4	− 0·7	− 0·7	·0016	Poor.	C	
" ..	2370	I.	" ..	" 13..	18	55	30	3	25 E.	− 2·0	− 1·9	3·0	2·9	·002	Fair	P	
" ..	2371	"	" ..	" 13..	19	23	24	3	00 E.	− 1·9	− 2·0	2·9	2·8	·002	"	P	
" ..	2384	"	" ..	" 15..	19	32	27	2	29 E.	− 5·0	− 5·2	− 0·8	− 1·2	·002	Good.....	H	
" ..	2385	"	" ..	" 15..	20	00	27	2	13 E.	− 5·2	− 5·0	− 1·2	− 1·2	·002	"	H	
" ..	2454	"	" ..	" 31..	20	05	30	1	00 E.	1·0	0·6	9·8	9·8	·002	"	C	
" ..	2455	"	" ..	" 31..	20	39	32		25 E.	0·6	0·0	9·8	9·7	·002	"	C	

ε HERCULIS 786.

1907. May 24. Observed by J. S. PLASKETT.
G. M. T. 18h 25m Measured by W E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	73·9685	4891·134	...	...	...	...	3	52·5955	4460·292	...	...	...	...
1½	73·1420	4871·413	...	...	...	...	3	47·6274	4379·348	...	...	...	...
2	72·6821	4860·564	607	·527	·920	−56·76	2	45·0505	4339·626	·714	·634	·920	−63·48
2	56·5256	4528·760	...	...	...	...	3	44·1325	4325·827	...	...	...	...
½	53·8061	4480·945	·985	·400	·415	−27·76							

Weighted mean		−56·53
V_a	+ 1·45	
V_d		− ·04
Curvature		− ·28
Radial velocity		−55·4

ε HERCULIS 801.

1907. May 31. Observed by J. S. PLASKETT.
G. M. T. 17h 38m Measured by C. R. WESTLAND.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0174	...	...	...	1	53·9504	·9078	·0620	71·36
2	72·8193	·8105	·0543	−78·79	2	53·1565	...	...	...
2	72·4559	...	...	...	2	45·2192	·1557	·0830	−86·65
2	54·7825	...	...	...	2	45·3368	...	...	...

Weighted mean	−80·45
V_a	− ·68
V_d	− ·02
Curvature	− .28
Radial velocity	−81·4

ε HERCULIS 810.

1907. June 8. Observed by J. S. PLASKETT.
G. M. T. 19h 28m Measured by C. R. WESTLAND.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9982	...	...	...	3	53·9506	·8942	·0756	−87·02
1	72·8130	·8281	·0367	−53·25	2	53·1734	...	...	...
2	72·4367	...	...	...	2	45·3626	...	...	...
2	54·7931	...	...	...	1	45·2450	·1556	·0831	−86·76

Weighted mean	−80·21
V_a	− 3·00
V_d	− ·19
Curvature	− ·28
Radial velocity	−83·7

ε HERCULIS 816.

1907. June 10.
G. M. T. 17ʰ 47ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement.	Velocity.
2	73·3707	4875·671	......	......	......	....	1½	53·2681	4470·617	......	...	......	......
1½	72·9235	4865·085	......	......	......	....	2	45·2728	4341·820	......	......	......	......
1	72·7904	4861·951	·807	·527	·320	+19·74	2	45·2356	4341·256	·594	·634	·040	− 2·7
2	54·3881	4489·915	......	......	......	....	½	27·4999	4102 238	·106	·890	·216	+15·6
1	53·9850	4482·931	·150	·400	·750	+50·17	3	27·3170	4100·053	......	......	......	......

Weighted mean		+16·04
V_a	− 3·57	
V_d	− ·07	
Curvature	− ·28	
Radial velocity		+12·7

ε HERCULIS 827.

1907. June 11.
G. M. T. 15ʰ 39ᵐ

Observed by }
Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9503	....	....	....	1	54·0175	·0116	·0448	+51·5
1	72·8122	·8724	·0076	+11·02	3	45·3037	....	....	......
2	72·3825	....	....	....	½	45·2540	·2237	·0150	−15·6
2	54·0317	....	....	....					

Weighted mean		+21·90
V_a	−3·86	
V_d		+·07
Curvature	− ·28	
Radial velocity		+17·8

ε HERCULIS 838.

1907. June 12.
G. M. T. 18ʰ 35ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9986	....	....	....	2½	45·2585	·1957	·0430	44·8
1½	72·8160	·8258	·0390	−56·59	2	45·3356	....	....	......
2	72·4380	....	....	....	½	27·4375	·3116	·1010	−87·6
2	54·0675	....	....	....	2	27·3726	....	....	......
½	53·9500	·9113	·0585	67·33					

Weighted mean	−54·93
V_a	− 4·15
V_d	− ·14
Curvature	− ·28
Radial velocity	−59·5

ε HERCULIS 838.

1907. June 12.
G. M. T. 18^h 35^m

Observed by J. S. PLASKETT.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9608	....	....	....	1	45·2100	·1853	·0534	55·74
1	72·7742	·7756	·0392	−56·87	2	43·5655	....	....	....
1½	72·3915	....	....	....	½	27·4011	·3175	·0951	−82·54
2	45·2982	....	....	....	2	27·33 3	....	....	....

Weighted mean .... −61·55
V_a .... − 4·15
V_d .... − ·14
Curvature .... − ·28

Radial velocity .... −66·1

The mean of the two measurements, −61·7 used.

ε HERCULIS 847.

1907. June 13.
G. M. T. 18^h 25^m

Observed by W. E. HARPER.
Measured by C. R. WESTLAND.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7738	....	....	....	2	45·3226	....	....	....
2	53·9268	·8948	·0750	−86·32	2	45·1962	·1472	·0915	−95·52
2	53·1442	....	....	....					

Weighted mean .... −90·87
V_a .... − 4·43
V_d .... − ·16
Curvature .... − ·28

Radial velocity .... −95·7

ε HERCULIS 847.

1907. June 13.
G. M. T. 18^h 25^m

Observed by W. E. HARPER.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72 9662	....	....	....	1	52·2373	....	....	....
½	72·7752	·8186	·0462	−67·03	2	48·7615	....	....	....
1	72·4080	....	....	....	½	45·2105	·2068	·0319	−33·30
1	54·0198	....	....	....	1	45·2774	....	....	....
1	53·8890	·8900	·0708	−81·48					

Weighted mean .... −65·82
V_a .... − 4·43
V_d .... − ·16
Curvature .... − ·28

Radial velocity .... −70·7

Mean of two measurements, −83·2 used.

ε HERCULIS 851.

1907. June 14. Observed by J. S. Plaskett.
G. M. T. $17^h\ 43^m$ Measured by W. E. Harper.

Wt.	Mean of Settings.	Measured Wave Length.	Normal wave length.	Displacement.	Velocity.	Wt.	Mean of Settings.	Measured Wave Length.	Normal wave length.	Displacement.	Velocity.
2	73·3997	4875·675	......	......	....	1½	53·9475	4482·744	·400	·344	+23·74
1½	72·9468	4864·956	......	......	....	2	45·2453	4341·337	....	......	....
1	72·8165	4861·887	.527	·360	+22·21	1½	45·2036	4340·534	·634	·100	− 6·9
1	72·3854	4851·790	......	......	....	1	27·4152	4101·900	·890	·010	+ 0·7
1	53·9856	4482·656	......	......	....	2	27·2529	4099·650	.....	......	....

Weighted mean		+ 9·64
V_a	− 4·72	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+ 4·5

ε HERCULIS 851.

1907. June 14. Observed by J. S. Plaskett.
G. M. T. $17^h\ 43^m$ Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0227	....	....	....	1	53·1210	....	....	....
1	72·8756	·8898	·0250	+36·27	½	45·2536	·2267	·0120	−12·5
½	72·4630	....	....	....	2	45·3006	....	....	....
1	54·7568	....	....	....	2	27·2977	....	....	....
1	54·0085	·9991	·0293	+33·72	1	27·4617	·4108	·0018	− 1·5

Weighted mean		+17·76
V_a	− 4·72	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+12·7

The mean of two measurements, +7·0 used.

ε HERCULIS 862.

1907. June 20, Observed by W. E. Harper.
G. M. T. $16^h\ 37^m$ Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	72·9908	....	....	....	2	53·1120	....	....	....
2	72·4301	....	....	....	2	45·2676	....	....	....
1	72·8461	·8644	·0004	− 0·29	1	45·1917	·1977	·0410	−42·7
2	54·7464	....	....	....	2	27·2746	....	....	....
½	53·9312	·9290	·0408	−46·96	¼	27·3742	·3462	·0764	−57·7

Weighted mean	− 31·26
V_a	− 6·33
V_d	− ·07
Curvature	− ·28
Radial velocity	−37·9

ε HERCULIS 862.

1907. June 20.
G. M. T. 16h 37m

Observed by W. E. HARPER.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions	Velocity.
1	73·0166	....	....	....	1	45·2182	·1950	·0437	45·62
1	72·8604	·8527	·0121	−17 55	2	43·5599	....	....	....
2	72·4557	....	....	....	1	27·4358	·3833	·0293	−25·43
2	45·2969	....	....	....	2	27·2991	....	....	....

Weighted mean.................. −27·53
V_a .... − 6·33
V_d .... − ·07
Curvature...................... − ·28

Radial velocity................ −34·2

Mean of measurements,—34·5 used.

ε HERCULIS 871.

1907. June 21.
G. M. T. 18h 10m

Observed by J. S. PLASKETT.
Measured by J. N. TRIBBLE.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	72·9582	....	....	....	1½	45·1420	·1655	·0732	76·39
2	72·3957	....	....	....	1½	27·2546	....	....	....
1½	72·7847	·8357	·0291	−42·22	½	27·3658	·3578	·0641	−55·63
2	45·2501	....	....	....					

Weighted mean.................. −58·78
V_a .... − 6·49
V_d .... − ·19
Curvature...................... − ·28

Radial velocity................ −65·7

ε HERCULIS 881.

1907 June 25.
G. M. T. 16h 04m

Observed by }
Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	49·4200	....	....	....	½	27·3185	·3189	·1030	−89·40
1	45·2146	·1775	·0612	−63·89	1	27·2462	....	....	....
2	44·2931	....	....	....					

Weighted mean.................. −72·40
V_a .... − 7·64
V_d .... − ·04
Curvature...................... − ·28

Radial velocity................ −80·4

ε HERCULIS 893.

1907. June 27.
G. M. T. 16h 32m

Observed by W. E. Harper.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	73·2721	....	....	....	1	53·9786	·9741	·0043	4·95
2	72·9900	....	....	....	2	45·2810	....	....	....
½	72·8555	·8745	·0097	+14·07	½	45·2918	·2843	·0456	+47·59
2	54·0335	....	....	....					

Weighted mean..................		+12·64
V_a	−8·22	
V_d	−·11	
Curvature.. ...	−·28	
Radial velocity................		+4·0

ε HERCULIS 913.

1907. July 4.
G. M. T. 16h 18m

Observed by W. E. Harper.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·0216	......	....	....	2	45·2683	....	....	....
2	53·9485	·9557	·0141	−16·22					

Weighted mean..........	−16·22
V_a	−9·98
V_d	−·14
Curvature.........	−·28
Radial velocity.....	−26·6

ε HERCULIS 920.

1907. July 8.
G. M. T. 16h

Observed by J. S. Plaskett.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	72·9265	....	....	... ...	2	45·2319	....	....	....
2	72·3632	....	....	....	1	45·1886	·2403	·0084	8·79
1½	72·7804	·8172	·0015	−2·17	2	27·2471	....	....	....
1½	53·9754	....	....	....	½	27·4015	·4763	·0202	−17·60
½	53·9156	·9556	·0010	−1·15					

Weighted mean.....	−6·12
V_a	−10·92
V_d	−·14
Curvature....	−·28
Radial velocity...	−17·5

ε HERCULIS 928.

1907. July 9.
G. M. T. 14^h 32^m

Observed by } J. N. TRIBBLE.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	54·0232	....	....	....	1	45·2855	·2775	·0388	49·90
½	54·0319	·0375	·0677	+77·91	1½	30·9135	....	....	....
2	45·2815	....	....	....	1	29·6773	·6342	·0501	+44·42

Weighted mean..................		+53·31
V_a..................	−11·26	
V_d..................	− ·11	
Curvature..................	− ·28	
Radial velocity..................		+41·6

ε HERCULIS 928.*

1907. July 9.
G. M. T. 14^h 32^m

Observed by J. N. TRIBBLE.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	72·9585	....	....	....	2	53·9874	....	....	....
1½	72·8250	·8764	·0116	+ 16·83	½	53·9415	·9829	·0131	+15·08
1	72·3931	....	....	....	2	45·2441	....	....	....
½	57·8595	·8969	·0700	[+ 84·28]	1½	45·2136	·2431	·0044	+ 3·82
1	57·7826	....	....	....	2	29·6396	·6406	·0417	+37·00
½	57·6674	7048	·1220	[−144·48]	2	29·5979	....	....	....

Weighted mean..................		+20·60
V_a..................	−11·26	
V_d..................	− ·11	
Curvature..................	− ·28	
Radial velocity..................		+ 9·0

* This result used.

ε HERCULIS 937.

1907. July 10.
G. M. T. 14^h 55^m

Observed by J. S. PLASKETT.
Measured by J. N. TRIBBLE.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9735	....	....	....	1	45·2284	·2288	·0199	−20·83
1	72·8361	·8261	·0054	+ 7·84	2	27·2965	....	....	....
2	45·2832	....	....	....	½	27·4291	·4545	·0420	−36·60

Weighted mean..................	−20·86
V_a..................	−11·49
V_d..................	− ·09
Curvature..................	− ·28
Radial velocity..................	−32·7

ε HERCULIS 937.

1907. July 10. Observed by J. S. PLASKETT.
G. M. T. 14^h 55^m Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	54·6678	....	....	....	2	45·2121	....	....	....
1	53·8654	·9382	·0316	−36·37	1	45·1485	·2100	·0287	−29·96
1	53·0405	....	....	....					

Weighted mean	−33·16
V_a	−11·49
V_d	− ·09
Curvature	− ·28
Radial velocity	−45·0

Mean of measurements,—39·0 used.

ε HERCULIS 952.

1907. July 18. Observed by W. E. HARPER.
G. M. T. 16^h 10^m Measured by J. N. TRIBBLE.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9883	....	....	....	½	53·9283	·9333	·0365	42·01
2	72·4271	....	....	....	2	45 2698	....	....	....
1	72·8008	·8208	·0440	−63·85	1	45·2109	·2147	·0240	−25·05
2	54·0238	....	....	....					

Weighted mean	−43·96
V_a	−13·18
V_d	− ·19
Curvature	− ·28
Radial velocity	−57·6

ε HERCULIS 957.

1907. July 20. Observed by J. S. PLASKETT.
G. M. T. 16^h 39^m Measured by J. N. TRIBBLE.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9599	....	....	....	2	45·2827	....	....	....
2	72·3852	....	....	....	1	45·2473	·2482	·0000	0·00
1	72·8265	·8315	·0128	+18·34	2	27·3141	....	....	....
2	54·0154	....	....	....	½	27·5080	·5158	·0193	+16·8[illegible]
1	53·9642	·9642	·0076	+ 8·77					

Weighted mean	+10·15
V_a	−13·57
V_d	− ·19
Curvature	− ·28
Radial velocity	− 3·9

ε HERCULIS 976.

1907. Aug. 1.
G. M. T. $17^h\ 20^m$

Observed by / Measured by } J. N. TRIBBLE.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0008	......	....	....	2	45·2806	....	....	....
½	72·8353	·8443	·0205	−29·74	1	45·2454	·2384	·0003	0·00
2	54·0320	....	....	....	2	27·2821	....	....	....
2	53·9627	·9595	·0103	11·85	½	27·4465	·4110	·0109	−9·46

Weighted mean	−10·79
V_a	−15·51
V_d	− ·27
Curvature	− ·28
Radial velocity	−26·8

ε HERCULIS 979.*

1907. Aug. 3.
G. M. T. $13^h\ 28^m$

Observed by J. S. PLASKETT.
Measured by TRIBBLE & HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9868	....	....	....	½	27·4924	·4509	·0290	+25·17
½	72·8703	·8953	·0305	+44·26	2	54·7430	....	....	....
2	54·0237	....	....	....	1½	54·0280	·0278	·0620	+71·36 red.
2	54·0309	·0360	·0662	+76·19					
2	54·7369	....	....	....	C'ntre	53·9537	·9535	·0163	+18·76
2	45·2775	....	....	....	½	53·8760	·8758	·0940	−108·19 violet.
1	45·2820	·2780	·0393	+41·08					
2	27·2883	....	....	....	2	53·1113	....	....	....

*Plate not used in the results.

ε HERCULIS 987.

1907. Aug. 6.
G. M. T. $17^h\ 35^m$

Observed by / Measured by } J. N. TRIBBLE.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·6897	....	....	....	2	44·9542	....	....	....
½	72·5573	·7843	·0122	+17·75	1	44·9849	·2833	·0244	+25·63

Weighted mean		+22·96
V_a	−16·16	
V_d	− ·28	
Curvature	− ·28	
Radial velocity		+6·2

ε HERCULIS 1018.

1907. Aug. 22. Observed by W. E. Harper.
G. M. T. 10^h 49^m Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·0698	....	....	....	2	45·2977	....	....	....
1	54·0566	·0156	·0458	+52·71	½	45·3014	·2774	·0387	+40·39

Weighted mean		+48·60
V_a	−17·45	
V_d	− ·27	
Curvature........	− ·28	
Radial velocity..........		+30·6

ε HERCULIS 1062.

1907. Sept. 20. Observed by W. E. Harper.
G. M. T. 14^h 37^m Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·0379	....	....	....	2	45·2630	....	....	....
1	53·9738	·9647	·0051	− 5·86	1	45·2412	·2512	·0125	+13.04

Weighted mean................	+ 3·59	
V_a		− 5·90
V_d		− ·28
Curvature...............		− ·28
Radial velocity..........................		− 2·9

ε HERCULIS 1391.

1908. March 9. Observed by, Measured by W. E. Harper.
G. M. T. 20^h 50^m

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7533	....	....	....	½	27·3570	·3650	·0566	49·1
2	53·9358	·9253	·0445	−51·22	2	27·2385	....	....	....
2	53·1215	....	....	....	½	11·7667	·7897	·0617	−46·2
2	45·2735	....	....	....	2	11·4840	....	....	....
1	45·2060	·2061	·0326	34·03					

Weighted mean....................		−46·03
V_a	+17·56	
V_d	+ ·14	
Curvature....................		− .28
Radial velocity........................		−28·6

ε HERCULIS 1403.

1908. March 16.
G. M. T. 21h 42m

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7088	....	....	....	1	27·4090	·3380	·0746	[−64·75]†
1	53·8238	·8561	·1137	−129·87	1	27·3376	·2666	1460	−126·73‡
2	53·0835	....	....	....	2	27·3180	....	....	....
3	45·2754	....	....	....	½	11·8287	·7037	·1477	−110·63
2	45·1363	·1345	·1042	−108·78	2	11·6327	....	....	....
1	27·4961	·4251	·0125	[+10·85]*					

Weighted mean 4 lines.............. −117·66
V_a.............. +16·96
V_d.............. + ·05
Curvature.............. − ·28

Radial velocity.............. −100·9

* Red. † Centre. ‡ Violet.

ε HERCULIS 1483.

1908. April 13.
G. M. T. 21h 35m

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	55·0591	·0413	·0839	− 97·83	½	45·2031	·1830	·0557	−58·15
2	54·7597	....	....	....	2	73·0290	....	....	....
3	53·8897	·8728	·0970	−111·65	2	66·3185	·2998	·1119	+145·09
2	53·1281	....	....	....	1	41·4857	·4625	·1653	+165·30
2	45·2936	....	....	....	2	41·3097	....	....	....

Weighted mean neg. lines.............. −102·63
V_a.............. +12·31
V_d.............. − ·09
Curvature.............. − ·28

Radial velocity.............. − 90·7

ε HERCULIS 1494.

1908. April 15.
G. M. T. 20h 40m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7571	....	....	....	1	27·5470	·4416	·0290	25·17
1	54·0087	·9910	·0212	+24·40	2	27·3528	....	....	....
2	53·1325	....	....	....	1½	12·0567	·8947	·0433	+32·43
2	45·3117	....	....	....	2	11·6701	....	....	....
1½	45·2995	·2614	·0227	23·70					

Weighted mean		+ 26·75
V_a		+ 11·87
V_d	− ·04	
Curvature	− ·28	
Radial velocity		+ 38·3

ε HERCULIS 1511.

1908. April 22.
G. M. T. 20h 33m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7537	....	....	....	1½	27·4398	·3576	·0550	47·74
1	53·9496	·9343	·0355	−40·86	2	27·3292	....	....	....
2	53·1311	....	....	....	1	11·9322	·7951	·0557	−41·72
2	45·2841	....	....	....	2	11·6453	....	....	....
1½	45·2051	·1947	·0440	45·93					

Weighted mean		− 44·61
V_a	+ 10·16	
V_d		− ·05
Curvature		− ·28
Radial velocity		− 34·8

ε HERCULIS 1511.*

1908. April 22. Observed by J. S. PLASKETT.
G. M. T. $20^h\ 53^m$ Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7475	....	....	....	1	27·4466	·3521	·0605	52·51
½	53·9314	·9240	·0498	−57·31	2	27·3416	....	....	....
2	53·1213	....	....	....	½	11·9315	·7915	·0600	−44·94
2	45·3027	....	....	....	2	11·6479	....	....	....
1	45·2245	·1995	·0393	41·02					

Weighted mean..................		− 48·22
V_a	+ 10·16	
V_d		− ·05
Curvature....................		− ·28
Radial velocity................		− 38·4

* Check measurement.

ε HERCULIS 1531.

1908. May 15. Observed by W. E. HARPER.
G. M. T. $19^h\ 29^m$ Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0237	....	....	....	½	45·1314	·1565	·0822	85·81
½	72·8254	·8127	·0521	−75·59	2	43·5083	....	....	....
1	72·4550	....	....	....	½	27·3377	·3301	·0825	−71·04
1	45·2488	....	....	....	2	27·2542	....	....	....

Weighted mean		− 77·48
V_a	+ 3·87	
V_d		− ·11
Curvature....................		− ·28
Radial velocity................		− 74·0

ε HERCULIS 1531.*

1908. May 15. Observed by / Measured by } W. E. HARPER.
G. M. T. $19^h\ 29^m$

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	45·2620	....	....	....	2	15·3652	....	....	....
1½	45·1435	·1651	·0736	−76·84	1	15·3325	·3730	·1003	77·63
1	27·2702	·8206	·0920	79·86	½	11·7025	·7530	·0984	−73·70
2	27·1935	....	....	....	2	11·4650	....	....	....

Weighted mean..................		−77·40
V_a	+3·87	
V_d		− ·11
Curvature....................		− ·28
Radial velocity................		−73·9

* Check measurement.

ε HERCULIS 1540.

1908. May 18.
G. M. T. 18^h 25^m

Observed by } T. H. PARKER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72 9755	....	....	....	½	45·2462	·2547	·0160	16·70
½	72·8376	·8724	·0076	+11·02	2	43·5332	....	....	....
1	72·4074	....	....	....	2	27·2667	....	....	....
2	45·2650	....	....	....	½	27·4414	·4203	·0077	+ 6·68

Weighted mean.................... +11·47
V_a.................... + 3·01
V_d.............. − ·04
Curvature........ − ·28

Radial velocity.................... +14·2

ε HERCULIS 1540.*

1908. May 18.
G. M. T. 18^h 25^m

Observed by T. H. PARKER.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	57·8390	....	....	....	½	27·4464	·3946	·0180	15·62
½	57·8150	·8054	·0214	−25·76	2	27·2984	....	....	....
2	54·7533	....	....	....	1	11·9200	·8464	·0050	− 3·75
1	53·9750	9629	·0019	− 2·18	2	11·5812	....	....	....
1½	53·1249	....	....	....					

Weighted mean.................... − 4·73
V_a.............. + 3·01
V_d.................... − ·04
Curvature.................. − ·28

Radial velocity.................... − 2·0

* Check measurement.

ε HERCULIS 1545.

1908. May 20.
G. M. T. 14^h

Observed by J. S. PLASKETT.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7596	....	....	....	½	27·4008	·3230	·0896	77·77
½	53·9253	·9080	·0618	−71·13	1	27·3245	....	....	....
2	53·0461	....	....	....	½	15·4875	·3780	·0953	−73·76
2	43·5702	....	....	....	1	15·5081	....	....	....

Weighted mean.................... −76·10
V_a.............. + 2·47
V_d.............. + ·07
Curvature.................. − ·28

Radial velocity.................... −73·8

ε HERCULIS 1547.

1908. May 22.
G. M. T. 18h 28m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7307	....	....	....	2	45·2669	....	....	....
½	53·9373	·9479	·0219	−25·21	½	45·1984	·2051	·0336	−35·08
2	53·1021	....	....	....					

Weighted mean		− 30·15
V_a	+ 1·93	
V_d		− ·04
Curvature		− ·28
Radial velocity		− 28·5

ε HERCULIS 1567.

1908. June 1.
G. M. T. 17h 30m

Observed by T. H. PARKER
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7282	....	....	....	2	45·2682	....	....	....
¾	53·8856	8976	·0722	−83·10	¼	45·1598	·1652	·0735	−76·73
2	53·1018	....	....	....					

Weighted mean	− 81·51
V_a	− 1·17
V_d	− ·16
Curvature	− ·28
Radial velocity	− 83·1

ε HERCULIS 1573.

1908. June 3.
G. M. T. 17h 56m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9922	....	....	....	2	53·1190	....	....	....
1	72·8323	·8513	·0135	−19·59	2	45·2871	....	....	....
2	72·4216	....	....	....	1½	45·2517	·2382	·0005	0·52
2	54·7443	....	....	....	1	27·4595	·4062	·0064	−5·55
½	53·9692	·9645	·0053	6·10	2	27·2999	....	....	....

Weighted mean	− 7·23
V_a	− 1·74
V_d	− ·06
Curvature	− ·28
Radial velocity	− 9·3

ε HERCULIS 1573.*

1908. June 3.
G. M. T. 17^h 56^m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0222	....	....	....	½	45·2750	·2294	·0093	9·71
½	72·8697	·8570	·0078	−11·32	½	27·4850	·4000	·0126	−10·94
2	72·4536	....	....	....	2	27·3321	....	....	....
2	45·3195	....	....	....					

Weighted mean	−10·66
V_a	− 1·74
V_d	− ·06
Curvature	− ·28
Radial velocity	− 12·7

* Check measurement.

ε HERCULIS 1582.

1908. June 5.
G. M. T 18^h 40^m

Observed by } T. H. PARKER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0057	....	....	....	2	45·2847	....	....	....
½	72·8289	·8328	·0320	−46·43	1	45·1877	·1766	·0621	64·83
1	72·4415	....	....	....	2	43·5492	....	....	....
1	54·7435	....	....	....	1	27·3405	·3509	·0617	−53·55
2	53·9113	·9085	·0613	70·55	2	27·2362	....	....	....
1	53·1160	....	....	....					

Weighted mean	−62·82
V_a	− 2·34
V_d	− ·13
Curvature	− ·28
Radial velocity	−65·6

ε HERCULIS 1603.

1908. June 12.
G. M. T. 18^h 35^m

Observed by } T. H. PARKER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0039	....	....	....	½	27·3556	·3660	·0466	40·44
½	72·8098	·8174	·0474	−68·77	2	27·2362	....	....	....
2	72·4334	....	....	....	2	54·7252	....	....	....
2	45·2849	....	....	....	1	53·9368	·9481	·0217	−24·97
1	45·1905	·1792	·0595	62·11	1	53·0175	....	....	....
3	43·5509	....	....	....					

Weighted mean	−47·23
V_a	− 4·39
V_d	− ·14
Curvature	− ·28
Radial velocity	−52·0

ε HERCULIS 1603.*

1908. June 12. G. M. T. 18ʰ 35ᵐ

Observed by T. H. PARKER.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions,	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7390	....	....	....	1	45·1900	·1834	·0553	−57·73
1½	53·9468	·9515	·0183	−21·06	2	45·2802	....	....	....
1	53·1052	....	....	....					

Weighted mean................	−35·73
V_a................	− 4·39
V_d................	− ·14
Curvature................	− ·28
Radial velocity................	−40·5

* Check measurement.

ε HERCULIS 1625.

1908. June 22. G. M. T. 17ʰ 27ᵐ

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7181	....	....	....	½	27·4445	·4251	·0125	+10·85
2	53·9437	·9684	·0014	− 1·91	2	27·2660	....	....	....
2	53·0867	....	....	....	½	11·8797	·8502	·0012	− 0·90
2	45·2605	....	....	....	2	11·5367	....	....	....
1	45·2005	·2137	·0250	−26·10					

Weighted mean................	− 6·24
V_a................	− 7·15
V_d................	− ·11
Curvature................	− ·28
Radial velocity................	−13·8

ε HERCULIS 1630.

1908. June 24. G. M. T. 16ʰ 27ᵐ

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0647	....	....	....	2	45·3237	....	....	....
1	72·9033	8481	·0167	−24·23	2	45·2575	·2074	·0313	32·68
2	72·5011	....	....	....	1½	27·4458	·3860	·0266	23·09
2	54·7925	....	....	....	2	27·3065	....	....	....
1½	53·9978	·9484	·0214	24·63	2	11·8987	·8362	·0152	−11·38
2	53·1602	....	....	....	2	11·5698	....	....	....

Weighted mean................	− 23·00
V_a................	− 7·68
V_d................	− ·04
Curvature................	− ·28
Radial velocity................	− 31·0

ε HERCULIS 1640.

1908. June 26.
G. M. T. $16^h\ 46^m$

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7353	....	....	....	2	53·1042	....	....	....
1	53·9739	·9826	·0128	+14·73					

V_s .... + 14·73
V_a .... − 8·21
V_d .... − ·09
Curvature.......... − ·28

Radial velocity.................... + 6·1

ε HERCULIS 1648.

1908. June 27.
G. M. T. $17^h\ 07^m$

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·6613	....	....	....	2	27·3914	·4389	·0266	22·06
1½	53·9578	·0373	·0675	+77·80	3	27·2075	....	....	....
2	53·0325	....	....	....	1	11·8777	·9092	·0578	+43·29
2	45·2056	....	....	....	3	11·4693	....	....	....
1½	45·1725	·2405	·0018	1·88					

Weighted mean.................... + 34·49
V_a .... − 8·47
V_d .... − ·11
Curvature .... − ·28

Radial velocity.................... + 25·6

ε HERCULIS 1648.*

1908. June 27.
G. M. T. $17^h\ 07^m$

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0323	....	....	....	2	45·3181	....	....	....
1	72·9046	·8746	·0098	+14·22	1½	45·2971	·2531	·0144	15·05
2	72·4869	....	....	....	1½	27·5276	·4536	·0410	35·59
2	54·7837	....	....	....	3	27·3309	....	....	....
1½	54·0660	·0260	·0562	64·69	1½	12·0159	·9229	·0715	+53·63
2	53·1513	....	....	....	3	11·5935	....	....	....

Weighted mean.................... + 42·15
V_a .... − 8·47
V_d .... − ·11
Curvature .... − ·29

Radial velocity.................... + 29·4

* Check measurement.

ε HERCULIS 1648.*

1908. June 27.
G. M. T. 17h 07m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	51·7470	....	....	....	½	27·4466	·4322	·0196	17·01
1	54·0110	·0063	·0365	+42·01	2	27·2610	....	....	....
2	53·1164	....	....	....	1	11·9287	·9037	·0523	+39·17
2	45·2902	....	....	....	2	11·5322	....	....	....
1½	45·2737	·2571	·0184	19·21					

Weighted mean.................. +29·62
V_a .... − 8·47
V_d .... − ·11
Curvature ..... − ·28

Radial velocity.... .... + 20·8

* Check measurement.

ε HERCULIS 1653.

1908. July 1.
G. M. T. 16h 15m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7746	....	....	....	1	27·5156	·4756	·0630	54·68
2	54·0547	·0247	·0549	+63 19	3	27 2893	....	....	....
2	53·1395	....	....	....	1½	11·9291	·8871	·0357	+26·76
2	45·3045	....	....	....	3	11·5478	....	....	....
1	45·2795	·2490	·0103	10·75					

Weighted mean.................. +42·17
V_a .... − 9·48
V_d .... − ·11
Curvature ..... − ·28

Radial velocity......... ..... +33·3

ε HERCULIS 1653.*

1908. July 1.
G. M. T. 16h 15m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7392	....	....	....	½	27·4403	·4400	·0274	23·78
1	53·9887	·9943	·0245	+28·20	2	27·2470	....	....	....
1	53·1035	....	....	....	1	11·8804	·8856	·0342	+25·61
2	45·2625	....	....	....	2	11·5020	....	....	....
½	45·2276	·2387	0000	·00					

Weighted mean .. .. +21·90
V_a .... − 9·48
V_d .... − ·06
Curvature...... − ·28

Radial velocity............. ..... +12·1

* Check measurement.

ε HERCULIS 1653.*

1908. July 1.
G. M. T. $16^h\ 15^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·8447	....	....	....	½	45·3489	·2537	·0150	15·66
1	53·0962	·9977	·0279	+32·11	1	11·9904	·8880	·0366	+27·41
2	53·2062	....	....	....	2	11·6096	....	....	....
2	45·3688	....	....	....					

Weighted mean .... +26·94
V_a .... − 9·48
V_d .... − ·11
Curvature .... − ·28

Radial velocity .... +17·1

* Check measurement.

ε HERCULIS 1661.

1908. July 3.
G. M. T. $19^h\ 40^m$

Observed by T. H. PARKER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7681	....	....	....	2	45·2998	....	....	....
2½	53·9294	·9004	·0694	−79·88	1	45·2548	·2268	·0119	−13·61
2	53·1436	....	....	....					

Weighted mean .... −49·53
V_a .... − 9·97
V_d .... − ·26
Curvature .... − ·28

Radial velocity .... −60·0

ε HERCULIS 1661.*

1908. July 3.
G. M. T. $19^h\ 40^m$

Observed by T. H. PARKER.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions	Velocity
2	54·7214	....	....	....	2	45·2530	....	....	....
2	53·8761	·8968	·0730	−84·02	¾	45·1670	·1877	0510	−53·24
2	53·0911	....	....	....					

Weighted mean .... −75·62
V_a .... − 9·97
V_d .... − ·26
Curvature .... − ·28

Radial velocity .... −86·1

* Check measurement.

ε HERCULIS 1666.

1908. July 6. G. M. T. $17^h\ 35^m$

Observed by J. S. PLASKETT. Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	54·7101	....	....	....	1½	27·3494	·3934	·0192	16·66
1	53·8800	·9180	·0518	−59·62	2	27·1962	....	....	....
2	53·0710	....	....	....	1	11·7754	·8284	·0230	−17·23
2	45·2333	....	....	....	2	11·4534	....	....	....
1½	45·1985	·2375	·0012	1·25					

Weighted mean	−20·74
V_a	−10·70
V_d	− ·06
Curvature	− ·28
Radial velocity	−31·7

ε HERCULIS 1666.*

1908. July 6. G. M. T. $17^h\ 35^m$

Observed by J. S. PLASKETT. Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8433	....	....	....	1½	45·2230	·2223	·0164	−17·20
½	57·8432	·8293	·0025	+ 3·01	½	27·3862	·3874	·0252	−21·87
2	54·7567	....	....	....	2	27·2454	....	....	....
2	53·9847	·9752	·0054	+ 6·21	½	11·8301	·8383	·0131	− 9·81
1	53·1164	....	....	....	2	11·5190	....	....	....
2	45·2745	....	....	....					

Weighted mean	− 5·54
V_a	−10·70
V_d	− ·06
Curvature	− ·28
Radial velocity	−16·6

* Check measurement.

ε HERCULIS 1675.

1908. July 8.
G. M. T. 15^h 47^m

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0235	....	....	....	3	45·2741	....	....	....
1	72·8670	·8534	·0114	−16·54	1½	45·2271	·2267	·0120	−12·53
2	72·4584	....	....	....	1	27·4307	·4076	·0050	− 4·34
2	54·7415	....	....	....	2	27·2697	....	....	....
1½	53·9786	·9803	·0105	+12·08	1	11·8571	·8288	·0226	−16·93
1½	53·1090	....	....	....	2	11·5355	....	....	....

Weighted mean	− 6·41
V_a	− 11·15
V_d	− ·07
Curvature	− ·28
Radial velocity	− 17·9

ε HERCULIS 1675.*

1908. July 8.
G. M. T. 15^h 47^m

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
½	57·7785	·8317	·0049	+ 6·02	1½	45·1881	·2350	·0037	− 3·86
2	57·7762	....	....	....	2	30·8478	....	....	....
2	54·6950	....	....	....	1	27·3860	·4072	·0054	− 4·69
2	53·9312	·9798	·0100	+11·51	2	27·2254	....	....	....
2	53·0617	....	....	....	1	11·8146	·8303	·0211	−15·80
2	45·2267	....	....	....	2	11·4915	....	....	....

Weighted mean	− 0·04
V_a	− 11·15
V_d	− ·07
Curvature	− ·28
Radial velocity	− 11·5

* Check measurement.

ε HERCULIS 1676.

1908. July 8.
G. M. T. 16h 32m

Observed by / Measured by } J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·8885	....	....	....	1	27·5711	·4031	·0095	8·25
1½	54·0948	·9498	·0200	−23·02	2	27·4152	....	....	....
2	53·2536	....	....	....	1	12·0378	·8489	·0025	− 1·87
2	45·4243	....	....	....	2½	11·6959	....	....	....
1	45·3866	·2356	·0031	3·24					

Weighted mean	− 10·64
V_a	− 11·15
V_d	− ·14
Curvature	− ·28
Radial velocity	− 22·2

ε HERCULIS 1682.

1908. July 9.
G. M. T. 17h 12m

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0156	....	....	....	1½	45·2675	·2565	·0178	+18·58
½	72·8768	·8714	·0066	+ 9·57	2	41·2977	....	....	....
2	72·4490	....	....	....	½	27·4402	·4102	·0024	− 2·08
2	54·7490	....	....	....	2	27·2766	....	....	....
3	54·0263	·0207	·0609	+70·09	½	11·9452	·9044	·0530	+39·70
2	53·1160	....	....	....	2	11·5482	....	....	....
2	45·2846	....	....	....					

Weighted mean		+ 42·97
V_a	− 11·36	
V_d	− ·15	
Curvature	− ·28	
Radial velocity		+ 31·2

ε HERCULIS 1685.

1908. July 10. Observed by } J. B. CANNON.
G. M. T. 14^h 37^m Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7810	....	....	....	1½	27·4458	·3880	·0246	21·35
2	53·9982	·9602	·0096	−11·49	2	27·3042	....	....	....
2	53·1500	....	....	....	1½	11·8880	·8260	·0254	−19·02
2	15·3197	....	....	....	2	11·5696	....	....	....
1	45·2720	·2260	·0127	13·26					

Weighted mean	−16·13
V_a	−11·58
V_d	·00
Curvature	−·28
Radial velocity	−27·9

ε HERCULIS 1686.

1908. July 10. Observed by } J. B. CANNON.
G. M. T. 15^h 34^m Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7365	....	....	....	½	27·4528	....	....	....
1½	53·9495	·9535	·0163	−18·76	2	27·2597	....	....	....
2	53·1102	....	....	....	1½	11·8304	·8099	·0415	−31·07
2	45·2762	....	....	....	2	11·5280	....	....	....
1	45·2158	·2146	·0230	24·01					

Weighted mean	−24·56
V_a	−11·58
V_d	−·06
Curvature	−·28
Radial velocity	−36·4

ε HERCULIS 1693.

1908. July 11. Observed by J. S. PLASKETT.
G. M. T. 16^h 58^m Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0160	....	....	....	1½	45·1437	·1197	·1198	125·07
1	72·7961	·7998	·0650	−94·52	1	27·2885	·2685	·1440	124·99
1	54·7200	....	....	....	2	27·2267	....	....	....
2	53·8695	·8415	·1283	147·67	1	11·7051	·6841	·1673	−115·31
2	53·0811	....	....	....	2	11·4860	....	....	....
2	45·2396	....	....	....					

Weighted mean	−125·81
V_a	−11·83
V_d	−·14
Curvature	−·28
Radial velocity	−138·1

ε HERCULIS 1693.*

1908. July 11.
G. M. T. 16^h 58^m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	54·6857	....	....	....	1½	27·2729	·3166	·0960	83·33
2	53·8389	·8908	·0790	−90·93	2	27·2031	....	....	....
1	53·0466	....	....	....	1	11·6737	·7328	·1186	−88·83
2	45·2135	....	....	....	2	11·4481	....	....	....
1	45·1326	·1927	·0460	48·02					

Weighted mean	−80·67
V_a	−11·83
V_d	− ·14
Curvature	− ·28
Radial velocity	−92·9

* Check measurement.

ε HERCULIS 1699.

1908. July 13.
G. M. T. 16^h 19^m

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9161	....	....	....	½	27·3386	·3706	·0513	+44·53
½	72·7681	·8611	·0037	− 5·37	2	27·2138	....	....	....
½	72·3520	....	....	....	1½	11·8957	·9057	·0543	+40·67
2	45·2128	....	....	....	2	11·4945	....	....	....
1	45·1745	·2353	·0034	− 3·55					

Weighted mean		+22·00
V_a	−12·28	
V_d	− ·14	
Curvature	− ·28	
Radial velocity		+ 9·3

ε HERCULIS 1699.*

1908. July 13
G. M. T. 16^h 19^m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·8786	....	....	....	1	52·9980	....	....	....
½	72·7355	·8648	·0000	0·00	2	45·1721	....	....	....
½	72·3211	....	....	....	1	45·1655	·2670	·0283	+29·54
2	54·6267	....	....	....	1½	11·8675	·9317	·0803	+60·14
1	53·8710	·9856	·0158	+18·18	2	11·4430	....	....	....

Weighted mean		+34·48
V_a	−12·28	
V_d	− ·14	
Curvature	− ·28	
Radial velocity		+21·8

* Check measurement.

ε HERCULIS 1707.

1908. July 14.
G. M. T. $17^h\ 42^m$

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9823	....	....	....	2	45·2751	....	....	....
1	72·8174	·8454	·0194	−28·15	2	45·2115	·2100	·0287	29·96
1	72·4157	....	....	....	2	27·4009	·3709	·0417	36·20
2	54·7221	....	....	....	2	27·2759	....	....	....
½	53·9413	·9573	·0125	14·39	2	11·8686	·8106	·0408	30·56
2	53·0976	....	....	....	2	11·5667	....	....	....

Weighted mean....................	−30·50
V_a	−12·58
V_d	− ·19
Curvature	− ·28
Radial velocity................	−43·6

ε HERCULIS 1712.

1908. July 15.
G. M. T. 17^h

Observed by / Measured by } J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7925	....	....	....	1	27·4303	·3593	·0533	46·26
½	53·9323	·8803	·0795	−91·50	2	27·3102	....	....	....
2	53·1660	....	....	....	1	11·7814	·7214	·1300	−97·37
2	45·3233	....	....	....	2	11·5675	....	....	....
1½	45·2363	·1863	·0524	54·71					

Weighted mean.	−67·88
V_a	−12·81
V_d	− ·14
Curvature.............. ...	− ·28
Radial velocity.....	−81·1

ε HERCULIS 1713.

1908. July 15.
G. M. T. $17^h\ 45^m$

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9943	....	....	....	2	45·2700	....	....	....
½	72·8335	·8495	·0153	−22·20	1½	45·1889	·1924	·0463	48·34
1	72·4275	....	....	....	1½	27·3745	·3583	·0543	47·13
2	54·7248	....	....	....	2	27·2630	....	....	....
1	53·8913	·9083	·0615	70·79	1½	11·8010	7715	·0799	−59·92
2	53·1022	....	....	....	2	11·5368	....	....	....

Weighted mean	−52·49
V_a	−12 80
V_d	− ·19
Curvature	− ·28
Radial velocity	−65·8

ε HERCULIS 1719.

1908. July 16.
G. M. T. $17^h\ 25^m$

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7686	....	....	....	1	27·4669	·4142	·0077	− 6·68
2	53·9945	·9675	·0023	− 2·65	2	27·2995	....	....	....
2	53·1399	....	....	....	2	11·9217	·8562	·0048	+ 3·59
2	45·3019	....	....	....	2	11·5731	....	....	....
1½	45·2698	·2368	·0019	− 1·98					

Weighted mean	− 0·27
V_a	− 13·03
V_d	− ·19
Curvature	− ·28
Radial velocity	− 13·8

ε HERCULIS 1720.

1908. July 22.
G. M. T. 17ʰ

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	57·8345	....	....	....	1	45·2245	·2144	·0173	−18·06
1	57·8370	·8333	·0065	+ 7·83	1½	24·1614	....	·0076	+ 6·46
1	54·7533	....	....	....	2	24·1536	....	....	....
1½	53·9636	·9510	·0188	−21·64	1	11·8589	·8290	·0224	−22·57
1	53·1255	....	....	....	2	11·5373	....	....	....
2	45·2867	....	....	....					

Weighted mean	−	9·26
V_a	−	14·00
V_d	−	·19
Curvature	−	·28
Radial velocity	−	23·7

ε HERCULIS 1723.

1908. July 24.
G. M. T. 14ʰ

Observed by / Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9270	....	....	....	2	53·0155	....	....	....
½	72·7558	·8416	·0232	−33·66	2	45·1800	....	....	....
1	72·3561	....	....	....	1½	45·1312	·2248	·0139	−14·51
2	59·7270	....	....	....	2	37·8697	....	....	....
1	58·9550	·0377	·0030	− 3·66	1½	37·6784	·7674	·0127	−12·24
1	57·7351	·8188	·0080	− 9·63	1	27·3058	·3850	·0276	−23·96
2	57·5079	....	....	....	2	27·1684	....	....	....
2	54·6556	....	....	....	1	11·7612	·8374	·0140	−10·49
1½	53·8752	·9665	·0033	− 3·80	2	11·4310	....	....	....

Weighted mean	−	8·20
V_a	−	14·35
V_d		·00
Curvature	−	·28
Radial velocity		23·8

ε HERCULIS 1728.

1908. July 25.
G. M. T. 17h 20m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·8772	....	....	....	1½	45·3992	·2740	·0353	+36·85
2	54·1331	·0021	·0323	+37·18	1	24·5975	·4648	·0522	+45·31
2	53·2387	....	....	....	2	24·3793	....	....	....
2	45·3988	....	....	....					

Weighted mean		+ 38·89
V_a	− 14·53	
V_d	− ·22	
Curvature	− ·28	
Radial velocity		+ 23·9

ε HERCULIS 1729

1908. July 26
G. M. T. 16h 58m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0485	....	....	....	2	53·1465	....	....	....
1	72·8867	·8482	·0166	−24·08	2	45·3092	....	....	....
2	72·4827	....	....	....	1½	45·2855	·2500	·0113	+11·80
1	57·8605	·8279	·0011	+ 1·32	1	27·4567	·4100	·0026	− 2·26
2	57·8620	....	....	....	2	27·2950	....	....	....
2	54·7767	....	....	....	1½	11·8964	·8496	·0018	− 1·35
1	53·9981	·9635	·0063	− 7·25	2	11·5540	....	....	....

Weighted mean	− 2·37
V_a	−14·71
V_d	− .20
Curvature	− .28
Radial velocity	− 17.6

ε HERCULIS 1734.

1908. July 28.
G. M. T. $17^h\ 12^m$

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·4230	......	......	......	1	45·1967	·2434	·0047	+ 4·91
2	59·7721	......	......	......	½	27·3527	·3951	·0175	−15·19
2	54·7033	......	......	......	2	27·2043	......	......	......
1	53·9145	·9547	·0151	−17·38	1	11·7436	·8210	·0304	−22·77
2	53·0702	......	......	......	2	11·4292	......	......	......
2	45·2269	......	......	......					

Weighted mean	−12·24
V_a	−15·07
V_d	− ·22
Curvature	− ·28
Radial velocity	− 27·8

ε HERCULIS 1737.

1908. July 29.
G. M. T. $14^h\ 22^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9830	......	......	......	1	29·8960	·9563	·0333	+32·10
1	72·8682	·8968	0320	+46·45	2	29·8627	......	......	......
1	72·4145	......	......	......	½	27·3845	·4478	·0352	+30·55
2	54·6912	......	......	......	2	27·1833	......	......	......
1	53·9795	·0321	·0623	+71·71	1½	11·8437	·9232	·0718	+53·78
2	54·0574	......	......	......	1	11·6321	......	......	......
2	45·2190	......	......	......	2	11·4277	......	......	......
1	45·2345	·2891	·0504	+52·61					

Weighted mean		+49·80
V_a	−15·17	
V_d	− ·06	
Curvature	− ·28	
Radial velocity		+34·3

ε HERCULIS 1738.

1908. July 29.
G. M. T. $15^h\ 08^m$

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7011	....	....	....	1	45·2290	·2753	·0366	+38·21
1	53·9824	·0240	·0542	+62.38	2	29·8783	....	....	....
2	53·0696	....	....	....	1	11·8603	·9186	·0672	+50·35
2	45·2273	....	....	....	2	11·4489	....	....	....

Weighted mean..........		+50·31
V_a..........	−15·17	
V_d..........	− ·11	
Curvature..........	− ·28	
Radial velocity..........		+ 34·7

ε HERCULIS 1743.

1908. July 29.
G. M. T. $18^h\ 05^m$

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0345	....	....	....	2	54·0317	·0317	·0619	+71·25
½	72·8884	·8670	·0022	+ 3·19	2	53·1037	....	....	....
2	72·4567	....	....	....	2	45·2694	....	....	....
2	54·7492	....	....	....	1	45·2692	·2734	·0347	+36·23
3	54·0298	....	....	....					

Weighted mean..........		+ 55·91
V_a..........	− 15·17	
V_d..........	− ·25	
Curvature..........	− ·28	
Radial velocity..........		+ 40·2

ε HERCULIS 1746.

1908. July 30.
G. M. T. $17^h\ 06^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7460	....	....	....	2	45·2629	....	....	....
2	53·9640	·9628	·0070	− 8·06	½	45·2283	·2390	·0003	+ 0·31
2	53·1102	....	....	....					

Weighted mean..........	− 6·47
V_a..........	− 15·27
V_d..........	− ·24
Curvature..........	− ·28
Radial velocity..........	− 22·3

ε HERCULIS 1751.

1908. July 31.
G. M. T. 15h 40m

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	57·8225	....	....	....	2	53·1145	....	....	....
½	57·7790	·7859	·0410	−49·36	2	45·2711	....	....	....
2	54·7461	....	....	....	½	45·1693	·1717	·0670	−69·95
1½	53·9111	·9078	·0620	−71·36					

Weighted mean	−	66·38
V_a	−	15·65
V_d	−	·15
Curvature	−	·28
Radial velocity	−	82·5

ε HERCULIS 1757.

1908. July 31.
G. M. T. 19h 05m

Observed by, Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0630	....	....	....	2	53·1403	....	....	....
1	72·8552	·8035	·0613	−88·95	2	45·2950	....	....	....
2	72·4921	....	....	....	2	45·1940	·1726	·0661	−69·00
2	54·7682	....	....	....	½	27·3792	·3631	·0495	−42·97
1½	53·9147	·8874	·0824	−94·84	1	27·2627	....	....	....

Weighted mean	−	78·14
V_a	−	15·65
V_d	−	·28
Curvature	−	·28
Radial velocity	−	94·3

ε HERCULIS 1760.

1908. Aug. 1.
G. M. T. 16h 49m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7274	....	....	....	2	45·2642	....	....	....
1½	53·9500	·9643	·0055	− 6·35	1	45·2251	·2345	·0043	− 4·4
2	53·0979	....	....	....					

Weighted mean	−	5·61
V_a	−	16·03
V_d	−	·22
Curvature	−	·28
Radial velocity	−	22·1

ε HERCULIS 1761.

1908. Aug. 5. Observed by J. S. PLASKETT.
G. M. T. 14^h 05^m Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0351	....	....	....	2	53·1047	....	....	....
1	72·8896	·8680	·0032	+ 4·64	2	45·2597	....	....	....
2	72·4630	....	....	....	1½	45·2062	·2201	·0186	−19·42
2	57·8205	....	....	....	1	27·3982	·4028	·0098	− 8·52
1½	57·8034	·8123	·0145	−17·46	2	27·2420	....	....	....
2	54·7326	....	....	....	1½	11·8337	·8494	·0020	− 1·50
1½	53·9471	·9554	·0144	−16·57	2	11·4915	....	....	....

Weighted mean	−12·04
V_a	−16·25
V_d	− ·08
Curvature	− ·28
Radial velocity	−28·6

ε HERCULIS 1774.

1908. Aug. 7. Observed by T. H. PARKER.
G. M. T. 15^h 35^m Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8210	....	....	....	½	45·2291	·2317	·0070	− 7·31
1	57·8004	·8088	·0180	−21·67	½	27·4238	·4026	0100	− 8·68
2	54·7349	....	....	....	2	27·2676	....	....	....
½	53·9647	·9711	·0013	+ 1·50	1½	11·8833	8514	·0000	0·00
2	53·1063	....	....	....	2	11·5393	....	....	....
2	45·2710	....	....	....					

Weighted mean	− 7·23
V_a	−16·35
V_d	− ·17
Curvature	− ·28
Radial velocity	−24·0

ε HERCULIS 1782.

1908. Aug. 15.
G. M. T. 16^h 50^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9712	......	......	......	2	53·9308	·9566	·0132	−15·19
1	72·8162	·8545	·0103	−14·94	2	53·0801	......	......	......
2	72·4052	......	......	......	2	45·2550	......	......	......
2	57·7983	......	......	......	2	45·2055	·2241	·0146	−15·24
1½	57·7814	·8125	·0143	−17·21	1	27·3902	·3902	·0336	−29·16
2	54·7181	......	......	......	2	27·2578	......	......	......

Weighted mean	−17·44
V_a	−17·09
V_d	− ·24
Curvature	− ·28
Radial velocity	−35·0

ε HERCULIS 1793.

1908. Aug. 19.
G. M. T. 14^h 41^m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	71·8997	......	......	......	1	66·5842	·5905	·0873	−37·19
1	71·8180	·8198	·0673	−29·58	2	61·4037	......	......	......
2	68·7255	......	......	......	½	61·1977	·2033	·0412	−16·93

Weighted mean	−30·09
V_a	−17·29
V_d	− ·15
Curvature	− ·28
Radial velocity	−47·8

ε HERCULIS 1818.

1908 Aug. 24.
G. M. T. 14^h 03^m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9400	......	......	......	1	53·0350	......	......	......
1	72·7367	·8053	·0595	−86·33	2	45·2000	......	......	......
2	72·3715	......	......	......	1½	45·1002	·1737	·0650	−67·86
2	54·6722	......	......	......	1	27·2776	·3336	·0790	−68·57
2	53·9557	......	......	......	2	27·1906	......	......	......
1	53·8285	·9018	·0680	−78·27					

Weighted mean	−74.44
V_a	−17·55
V_d	− ·15
Curvature	− ·28
Radial velocity	− 92·4

ε HERCULIS 1838.

1908. Aug. 27.
G. M. T. $15^h\ 50^m$

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9994				2	45·2716			
1	72·8367	·8463	·0185	−26·84	1	45·2345	·2365	·0022	− 2.30
2	72·4383				1	27·4216	·3991	·0135	−11·72
2	57·8226				2	27·2694			
1	57·8302	·8344	·0076	+ 9·15	1	11·8840	·8453	·0061	− 4.55
2	54·0265				2	11·5462			
1½	54·9656	·9679	·0019	−2·19					

Weighted mean	− 5·82
V_a	−17·66
V_d	− ·24
Curvature	− ·28
Radial velocity	−24·0

ε HERCULIS 1844.

1908. Aug. 28.
G. M. T. $14^h\ 07^m$

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0320				2	45·1750	·1561	·0826	−86·23
½	72·8382	·8158	·0490	−71·10	½	27·3755	·3441	·0685	−59·46
2	72·4677				2	27·2780			
2	54·0522				1	11·7305	·7394	·1120	−82·79
1	53·9207	·8973	·0725	−81·45	2	11·5485			
2	45·2925								

Weighted mean	−80·80
V_a	−17·63
V_d	− ·16
Curvature	− ·28
Radial velocity	−98·9

ε HERCULIS 1853.

1908. Aug. 31.
G. M. T. $13^h\ 52^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·0330				1	45·2510	·2530	·0143	+14·93
2	53·9830	·9788	·0100	+11·51	¼	27·4040	·4166	·0040	+ 3·47
2	45·2716				2	27·2340			

Weighted mean	+ 11·94
V_a	− 17·63
V_d	− ·16
Curvature	− ·28
Radial velocity	− 6·1

ε HERCULIS 1866.

1908. Sept. 4.
G. M. T. 14h 32m

Observed by J. B. CANNON.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·0286	....	....	....	2	45·2756	....	....	....
1½	53·9682	·9684	·0014	− 2·03	¾	45·2387	·2367	·0020	− 2·09

Weighted mean....................		− 2·05
V_a		− 17·56
V_d		− ·22
Curvature		− ·28
Radial velocity		− 20·1

ε HERCULIS 1903.

1908. Oct. 1.
G. M. T. 13h 12m

Observed by W. E. HARPER.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9627	....	....	....	2	53·0938	....	....	....
½	72·8369	·8850	·0202	+29·31	2	45·2707	....	....	....
2	72·3935	....	....	....	½	45·2698	·2727	·0340	35·96
2	54·7217	....	....	....	2	43·5385	....	....	....
½	53·9629	·9891	·0121	13·93	1	43·0812	·0811	·0308	+31·38

Weighted mean....................		+ 28·39
V_a	− 13·58	
V_d	− ·23	
Curvature......	− ·28	
Radial velocity		+ 14·3

ε HERCULIS 1903.*

1908. Oct. 1
G. M. T. 13h 12m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8380	....	....	....	2	54·0527	....	....	....
⅛	57·8367	·8255	·0113	−13·60	½	45·3017	·2673	·0286	+31·95
⅜	53·0120	·9881	·0183	+21·06	2	45·3080	....	....	....

Weighted mean		+ 22·17
V_a	− 13·58	
V_d	− ·23	
Curvature......	− ·28	
Radial velocity		+ 8·1

* Check measurement.

ε HERCULIS 1905.

1908. Oct. 2.
G. M. T. $12^h\ 23^m$

Observed by / Measured by } T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9333				½	53·9743	·0083	·0385	44·31
½	72·8133	·8888	·0240	+34·82	2	53·0845			
2	72·3735				2	45·2615			
2	54·7063				½	45·2510	·2631	·0244	+25·47

Weighted mean		+34·86
V_a	−16·17	
V_d	− ·19	
Curvature	− ·28	
Radial velocity		+18·2

ε HERCULIS 1905.*

1908. Oct. 2.
G. M. T. $12^h\ 23^m$

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0219				1	54·0557	9920	·0222	+25·55
½	72·9047	·8923	·0275	+39·90	2	45·3540			
2	72·4605				1½	45·3672	·2868	·0481	+50·22
2	54·0925								

Weighted mean		+40·28
V_a	−16·17	
V_d	− ·19	
Curvature	− ·28	
Radial velocity		+23·6

* Check measurement.

ε HERCULIS 1906.

1908. Oct. 2.
G. M. T. $13^h\ 18^m$

Observed by / Measured by } T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9878				2	45·2706			
½	72·8491	·8716	·0068	+9·86	1	45·2536		·0179	+18·69
2	72·4218				½	27·4469	·3999	·0127	−11·02
2	54·7350				2	27·2936			
½	53.9915	·9095	·0297	+34·18	½	15·5485	·4771	·0040	+ 2·93
2	53·1029				2	15·4700			

Weighted mean	+12·22	
V_a		−16·17
V_d		− ·23
Curvature		− ·28
Radial velocity		− 4·4

ε HERCULIS 1906.*

1908. Oct. 2. Observed by T. H. PARKER.
G. M. T. 13ʰ 18ᵐ Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0126	....	....	....	½	45·2729	·2434	·0047	+ 4·81
½	72·8790	·8759	·0111	+16·11	2	45·3031	....	....	....
2	72·4515	....	....	....	½	27·4884	·4016	·0110	− 9·55
2	54·0508	....	....	....	2	27·3237	....	....	....
¾	53·9882	·9662	·0036	− 4·14					

Weighted mean............. + 1·15
V_a.............................. −16·17
V_d.............................. − ·23
Curvature.......................... − ·28

Radial velocity..................... −15·5

* Check measurement.

ε HERCULIS 1917.

1908. Oct. 5 Observed by T. H. PARKER.
G. M. T. 12ʰ 45ᵐ Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	53·9338	....	....	....	1	53·9042	·9992	·0294	+33·84

Weighted mean............................ +33·84
V_a.................... −15·21
V_d.................... − ·22
Curvature.............. − ·28

Radial velocity......................... +18·1

ε HERCULIS 1926.

1908. Oct. 12. Observed by / Measured by T. H. PARKER.
G. M. T. 14ʰ 15ᵐ

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7809	....	....	....	2	45·3392	....	....	....
½	53·0112	·9684	·0014	− 1·61	½	45·2745	·2089	·0298	−31·1
2	53·1586	....	....	....					

Weighted mean............................ −16·36
V_a.............................. −12·99
V_d.............................. − ·28
Curvature.......................... − ·28

Radial velocity..................... −29·9

ε HERCULIS 1926.*

1908. Oct. 12.
G. M. T. 14h 15m

Observed by T. H. PARKER.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9282	....	....	....	1	53·9142	·9648	·0050	5·55
¼	72·7570	·8383	·0265	−38·45	2	45·2412	....	....	....
2	72·3640	....	....	....	¾	45·1955	·2281	·0106	−11·06
2	53·9777	....	....	....					

Weighted mean	−11·73
V_a	−12·99
V_d	− ·28
Curvature	− ·28
Radial velocity	−25·3

* Check measurement.

ε HERCULIS 1961.

1908. Nov. 13.
G. M. T. 10h 33m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9540	....	....	....	1½	45·1868	·1763	·0725	75·91
½	72·7900	·7980	·0207	−30·08	1	27·4609	·4488	·0394	34·36
2	72·3992	....	....	....	2	27·3340	....	....	....
2	54·0249	....	....	....	½	11·8665	·8626	·1378	−103·76
1	54·9106	·9010	·0556	64·16	2	11·6620	....	....	....
2	45·2941	....	....	....					

Weighted mean	−62·07
V_a	− 4·70
V_d	− ·23
Curvature	− ·28
Radial velocity	−67·3

ε HERCULIS 1961.*

1908. Nov. 13.
G. M. T. 10h 33m

Observed by W. E. HARPER.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9915	....	....	....	2	48·8173	....	....	....
½	72·8067	·8233	·0415	−60·22	½	48·1143	·0670	....	....
2	72·4317	....	....	....	2	45·3301	....	....	....
2	54·7682	....	....	....	1	45·2254	·1689	·0698	72·87
1	53·9192	·8912	·0603	62·42	1	27·4192	·3334	·0792	−67·74
2	53·1417	....	....	....	2	27·3324	....	....	....

Weighted mean	−66·75
V_a	− 4·69
V_d	− ·25
Curvature	− ·28
Radial velocity	−71·8

* Check measurement.

ε HERCULIS 1961.*

1908. Nov. 13. G. M. T. 10ʰ 33ᵐ

Observed by W. E. Harper. Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9300	....	....	....	2	53·0847	....	....	....
½	72·7524	·7849	·0338	−48·11	2	45·2672	....	....	....
2	72·3700	....	....	....	1	45·1730	·1894	·0593	62·09
2	54·7057	....	....	....	½	11·8557	·8791	·1213	−91·95
¼	53·8622	·8807	·0759	87·59	2	11·6345	....	....	....

Weighted mean	−68·24
V_a	− 4·70
V_d	− ·23
Curvature	− ·28
Radial velocity	−73·4

* Check measurement.

ε HERCULIS 1983.

1908. Nov. 26. G. M. T. 10ʰ 07ᵐ

Observed by W. E. Harper. Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9887	....	....	....	2	53·1422	....	....	....
2	72·4267	....	....	....	2	45·3295	....	....	....
2	57·8410	....	....	....	½	45·2686	·2237	·0250	−26·17
¼	57·8284	·7837	·0210	−25·32	2	27·3610	....	....	....
2	54·7670	....	....	....	2	11·6692	....	....	....
1	53·9637	·9227	·0339	39·12					

Weighted mean	−29·54
V_a	− ·79
V_d	− ·25
Curvature	− ·28
Radial velocity	−30·9

ε HERCULIS 1993.

1908. Dec. 2. G. M. T. 11ʰ 05ᵐ

Observed by J. B. Cannon. Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0015	....	....	....	2	54·0327	·9273	·0159	18·2
½	72·8197	·7353	·0368	−53·51	2	45·3945	....	....	....
2	72·4371	....	....	....	1	45·3182	·2173	·0416	−43·68
2	54·1072	....	....	....					

Weighted mean		−30·57
V_a	+ 1·12	
V_d		− ·28
Curvature		− ·28
Radial velocity		−30·0

ε HERCULIS 2263.

1909. Feb. 8.
G. M. T. 22ʰ 08ᵐ

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·8987	....	....	....	1	45·2382	·1897	·0692	79·51
½	72·7145	·7305	·0416	−60·49	½	27·5582	·5058	·0560	49·56
2	72·3414	....	....	....	2	27·4495	....	....	....
2	54·0360	....	....	....	½	12·1170	·1096	·0391	−29·56
1	53·9233	·8891	·0541	62·57	2	11·8145	....	....	....
2	45·3421	....	....	....					

Weighted mean		− 60·54
V_a	+ 17·19	
V_d	+ ·16	
Curvature		− ·28
Radial velocity		− 43·5

ε HERCULIS 2264.

1909. Feb. 8.
G. M. T. 23ʰ

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·8680	....	....	....	1	45·2202	·2118	·0471	−54·12
½	72·6942	·7400	·0321	−46·67	1	27·5152	·5061	·0551	−49·29
1	72·3157	....	....	....	2	27·4062	....	....	....
2	54·0053	....	....	....	1	12·0368	·0711	·0776	−58·66
1½	53·8918	·8878	·0554	−64·07	2	11·7743	....	....	....
2	45·3020	....	....	....					

Weighted mean		− 56·30
V_a	+ 17·19	
V_d	+ ·12	
Curvature		− ·28
Radial velocity		− 39·3

ε HERCULIS 2305.

1909. Feb. 22.
G. M. T. 21h 34m

Observed by J. B. CANNON.
Measured by W. E. HARPER

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9872	....	....	....	½	53·9658	·9111	·0321	−37·13
½	72·8275	·7571	·0150	−21·81	2	45·3275	....	....	....
2	72·4233	....	....	....	1	45·2636	·2295	·0294	−30·87
2	57·8428	....	....	....	½	27·4794	·4953	·0665	−58·22
1½	57·8125	·7522	·0303	−36·63	2	27·3812	....	....	....
2	54·0565	....	....	....					

Weighted mean		− 36·09
V_a	+ 17·95	
V_d	+ ·15	
Curvature		− ·28
Radial velocity		− 18·2

ε HERCULIS 2306.

1909. Feb. 22.
G. M. T. 22h 36m

Observed by J. B. CANNON.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9687	....	....	....	2	45·3155	....	....	....
½	72·8071	·7544	·0177	−25·74	1	45·2637	·2415	·0174	−18·27
1	72·4092	....	....	....	½	27·5020	·5276	·0342	−29·93
1	57·7942	....	....	....	2	27·3725	....	....	....
2	57·8290	·7477	·0348	−42·05	1	11·9835	·0905	·0582	−44·00
2	54·0450	....	....	....	2	11·7002	....	....	....
1	53·9530	·9100	·0332	−38·40					

Weighted mean		− 34·12
V_a	+ 17·95	
V_d	+ ·09	
Curvature		− ·28
Radial velocity		− 16·4

ε HERCULIS 2327.

1909. March 2.
G. M. T. 21h 12m

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9387	....	....	....	2	45·2988	....	....	....
½	72·8030	·7800	·0079	+11·49	1¼	45·3043	·2991	·0402	+42·21
2	72·3801	....	....	....	½	12·0685	·1891	·0404	+30·54
2	54·0227	....	....	....	2	11·6875	....	....	....
¾	53·9890	9681	·0249	+28·70					

Weighted mean .... +31·76
V_a .... +17·90
V_d .... + ·14
Curvature ..... − ·28

Radial velocity .... + 49·5

ε HERCULIS 2328.

1909. March 2.
G. M. T. 22h 26m

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	53·9935	....	....	....	2	45·2644	....	....	....
1	53·9260	·9343	·0091	−10·52	½	45·2350	·2642	.0053	+ 5·56

Weighted mean .... − 5·16
V_a .... +17·90
V_d .... + ·05
Curvature .... − ·28

Radial velocity .... + 12·5

ε HERCULIS 2370*.

1909. March 13.
G. M. T, 18h 35m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	50·9370	....	....	....	½	34·7430	34·7193	·1038	−100·00
1	50·8242	·8081	·0804	−93·05	2	34·6975	....	....	....

Weighted mean .... −95·36
V_a .... +17·44
V_d .... + ·19
Curvature.................... − ·30

Radial velocity .... −78·0

* This plate and all following were taken by the new single-prism Spectroscope.

ε HERCULIS 2371.

1909. March 13. Observed by J. S. PLASKETT.
G. M. T. 19h 23m Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	58·8462	....	....	....	1	50·8549	·8347	·0538	−62·27
½	58·7184	·6911	·0741	−94·51	½	34·7589	·7401	.0820	−79·00
2	50·9411	....	....	....	2	34·6926	....	....	....

Weighted mean		−71·66
V_a	+17·44	
V_d	+ ·19	
Curvature		− ·30
Radial velocity		− 54·3

ε HERCULIS 2384.

1909. March 15. Observed by W. E. HARPER.
G. M. T. 19h 32m Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	58·8228	....	....	....	2	50·9196	....	....	....
½	58·7768	·7729	·0077	+ 9·82	½	50·9081	·9094	·0209	+24·19

Weighted mean		+19·40
V_a		+17·16
V_d		+ ·18
Curvature	− ·30	
Radial velocity		+36·4

ε HERCULIS 2385.

1909. March 15. Observed by W. E. HARPER.
G. M. T. 20h 30m Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	58·8349	....	....	....	1	50·9261	·9091	·0206	+23·84
½	58·7924	·7764	·0112	+14·29	½	34·8678	·8413	·0192	+18·50
2	50·9379	....	....	....	2	34·7003	....	....	....

Weighted mean		+21·36
V_a		+17·16
V_d		+ ·18
Curvature	− ·30	
Radial velocity		+38·4

ε HERCULIS 2454.

1909. March 21.
G. M. T. 20^h 05^m

Observed by } J. B. CANNON.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	58·8306	....	....	....	1	50·9084	·9091	·0206	+23·84
½	58·7836	·7720	·0068	+ 8·67	½	34·7992	·8274	·0053	+ 5·11
2	50·9202	....	....	....	2	34·6456	....	....	....

Weighted mean		+15·34
V_a		+14·93
V_d		+ ·06
Curvature	− ·30	
Radial velocity		+30·0

ε HERCULIS 2455.

1909. March 31.
G. M. T. 20^h 39^m

Observed by } J. B. CANNON.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	58·8294	....	....	....	1	50·9111	·9091	·0206	+23·84
½	58·8022	·7917	·0265	+33·80	½	34·7789	·8005	·0216	−20·90
2	50·9229	....	....	....	2	34·6522	....	....	....

Weighted mean		+15·15
V_a		+14·93
V_d		+ ·06
Curvature	− ·30	
Radial velocity		+29·8

OBSERVING RECORD AND DETAILED MEASURES OF η BOÖTIS.

P.—Plaskett.
P[1].—Parker.
H.—Harper.
C.—Cannon.
T.—Tribble.

RECORD OF SPECTROGRAMS.

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure. G. M. T.	Duration.	Hour Angle at end.	Temperature. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width.	Seeing.	Observer.
				1906.	h. m.	m.	h. m.	Fahre	nheit.	Centi	grade.			
ηBoötis.	308	IL	Seed 27.	June 25	15 55	35	3 30W.	65·0	64·0	22·7	22·8	·001	Poor ...	P
" ..	313	"	" ..	" 27	14 35	35	2 15W.	75·6	74·0	27·1	27·0	·001	Fair....	P
" ..	318c	"	" ..	" 29	14 21	18	2 10W.	77·4	76·2	27·0	27·0	·0009	" ..	P
" ..	326	"	" ..	July 4	14 50	60	3 15W.	62·5	60·9	21·3	21·4	·001	Fair to good ..	P
" ..	333	"	" ..	" 6	15 00	70	3 40W.	71·5	68·0	25·3	25·4	·001	Fair....	P
" ..	366	"	" ..	Aug. 6	14 05	70	4 45W.	78·0	74·0	28·8	28·8	·001	Good...	P
" ..	372	"	" ..	" 8	14 15	75	5 10W.	80·8	77·5	29·5	29·3	·001	Fair....	P
				1907.										
" ..	657	"	" ..	Mar. 8	18 45	30	50E.	26·5	25·6	1·3	1·5	·0013	Fair....	P
" ..	670	"	" ..	" 20	18 32	45	10E.	28·6	28·3	2·8	2·9	·0013	Good...	P
" ..	691	"	" ..	Apr. 3	18 02	35	15W.	44·0	40·2	9·8	10·1	·001	Poor ...	P
" ..	731	"	" ..	" 19	18 35	10	1 37W.	34·8	34·5	10·4	10·4	·0013	Clouds .	P
" ..	739	"	" ..	" 26	17 30	30	1 07W.	42·0	40·4	9·0	9·0	·0013	Fair....	P
" ..	752	"	" ..	May 7	14 20	20	1 30E.	50·5	50·0	16·1	16·1	·0013	" ..	H
								Centi	grade.					
" ..	760	IIIL	" ..	" 14	17 55	34	2 05W.	11·7	11·7	15·0	15·0	·0012	Very poor..	H
" ..	764	"	" ..	" 20	16 25	55	1 45W.	6·0	5·3	9·2	9·2	·0012	Unst'dy	H
" ..	769	"	" ..	" 22	16 51	47	2 20W.	10·5	10·5	13·2	13·2	·0012	Cloudy.	P
" ..	774	IL	" ..	" 23	14 08	16	37E.	15·5	15·0	17·3	17·3	·0012	Fair....	H
" ..	779	"	" ..	" 24	15 01	12	20W.	11·8	12·0	16·4	16·4	·001	Good...	P
" ..	793	"	" ..	" 29	16 46	27	2 30W.	8·0	8·0	14·5	14·5	·001	Cloudy.	P
" ..	797	"	" ..	" 31	14 54	12	45W.	15·2	15·2	19·0	19·0	·001	Good...	P
" ..	812	"	" ..	June 10	13 35	35	1 48W.	16·6	15·6	18·2	18·0	·0009	" ..	P
" ..	868	"	" ..	" 21	14 27	25	1 40W.	25·4	24·6	28·9	28·9	·001	Hazy ..	P
" ..	891	"	" ..	" 27	14 55	30	2 35W.	22·0	22·0	24·5	24·5	·0012	Fair ...	H
" ..	918	"	" ..	July 8	15 09	18	3 30W.	21·5	21·1	22·4	22·4	·0012	" ...	P
" ..	950	"	" ..	" 18	13 57	26	3 00W.	27·0	26·0	28·5	28·5	·0012	Very hazy..	T
" ..	972	"	" ..	Aug. 1	13 39	25	3 37W.	22·2	21·0	25·2	25·2	·001	Hazy ..	H
" ..	990	IIIL	" ..	" 7	13 58	50	4 30W.	23·1	22·0	24·1	24·1	·0015	Poor ...	P

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure. G. M. T.	Duration.	Hour Angle at end.	Temperature. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width.	Seeing.	Observer.
				1908.										
" ..	1231	IL	" ..	Jan. 14	22 00	26	1 10E.	—16·5	—18·0	— 5·2	— 5·5	·001	Hazy...	H
" ..	1294	IIIL	" ..	" 27	20 12	50	1 52E.	—20·0	—18·0	—15·3	—15·3	·0013	Good...	H
" ..	1307	"	" ..	" 29	21 14	62	1 07E.	—25·3	—25·5	—13·7	—13·7	·0013	Unst'dy	P
" ..	1332	"	" ..	Feb. 17	22 30	40	1 45W.	—17·5	—18·0	—10·5	—10·5	·0015	Good...	P
" ..	1357	"	" ..	" 24	19 06	47	1 20E.	—16·5	—15·5	—19·0	—18·6	·0013	Unst'dy	H
" ..	1446	"	" ..	Mar. 30	20 52	40	3 50W.	0·5	0·5	6·0	6·0	·002	Fair....	H
" ..	1513	"	" ..	May 4	18 13	55	2 40W.	8·0	7·0	13·4	13·3	·0017	Good ..	P[1]H
" ..	1553	"	" ..	" 25	15 58	64	1 50W.	21·3	20·5	25·6	25·4	·0016	" ...	P[1]
" ..	1557	"	" ..	" 23	16 00	50	1 45W.	21·5	20·7	25·7	25·6	·0015	Fair....	P
" ..	1621	"	" ..	June 22.	14 10	30	2 35W.	20·0	19·6	24·0	23·8	·0015	" ..	P
" ..	1663	"	" ..	July 6	14 40	80	3 25W.	25·3	24·8	26·8	26·3	·0015	Good...	P
" ..	1710	"	" ..	" 15	14 41	102	4 11W.	19·5	18·0	21·8	21·6	·0015	Cloudy.	C
" ..	1792	"	" ..	Aug. 19	13 18	60	4 47W.	18·8	16·5	24·3	23·8	·0018	Good...	H
" ..	1867	"	" ..	Sept. 7	12 57	65	5 40W.	18·2	17·6	21·4	21·2	·0015	Fair....	P
				1909.										
" ..	2115	"	" ..	Jan. 7	23 23	60	10W.	—20·0	—20·5	—13·6	—13·6	·0016	Fair....	P
" ..	2209	"	" ..	" 30	18 37	45	3 20E.	— 8·3	— 8·5	— 2·8	— 2·9	·0016	Unst'dy	P
" ..	2283	"	" ..	Feb. 17	20 30	62	00	—12·0	—12·0	— 1·3	— 1·3	·0015	Good...	C
" ..	2396	"	" ..	Mar. 20	17 00	60	1 30E.	— 2·3	— 3·3	4·6	4·6	·0015	Fair ...	P

η BOÖTIS 308.

1906. June 25.
G. M. T. 15^h 55^m

Observed by J. S. PLASKETT.
Measured by J. N. TRIBBLE.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
3	65·1413	4583·661	......	......	......	....	1½	46·0370	4376·165	.....	......	......	....
2	62·3546	4550·101	·165	·766	·399	+26·28	1½	45·4280	4370·332	·276	·856	·420	30·61
1	60·7590	4531·441	·473	·201	·272	17·99	1½	41·8841	4337·216	......	......	......	....
1	60·5605	4529·147	·171	·807	·364	24·10	1	39·8944	4319·219	·191	·817	·374	38·64
1½	60·0525	4523·302	·318	·055	·263	17·43	¾	39·7049	4317·527	·503	·068	·435	30·21
2	57·5179	4494·721	......	......	......	....	1½	39·4547	4315·298	......	......	.....	.....
1½	54·9606	4466·816	......	......	......	....	¾	39·4909	4315·620	·600	·178	·422	29·33
¾	54·2971	4459·723	·651	·304	·347	23·32	2	37·0639	4294·322	.....	......	......	....
1¾	54.2685	4459·366	.....	.....	......	....	¾	33·1023	4260·796	·820	·503	·317	22·30
1½	53·8823	4455 320	·240	·962	·278	18·71	1	29·7582	4233·629	·685	·462	·223	15·79
¾	51·2524	4427·927	·855	·420	·435	29·45	1	31·9013	4250·924	·972	·643	·329	+23·21
1½	49·0104	4405·271	·199	·951	·320	21·78	2	22·9884	4181·569	......	......	......	....

Weighted mean	+23·08	
V_a		−24·87
V_d		− ·25
Curvature		− ·28
Radial velocity		− 2·3

η BOÖTIS 313.

1906. June 27.
G. M. T. 14^h 35^m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	70·0228	4549·704	......	......	......	....	1	58·7715	4425·974	·982	·608	·374	25·31
2	70·0646	4550·199	·143	·766	·377	+24.84	2	57·7472	4415·579	·571	·244	·327	22·20
2	68·8922	4536·420	·408	·965	·443	29·28	2	56·7110	4405·198	·194	·951	·243	16·80
1	68·4773	4531·556	·552	·202	·350	23·13	3S	56·6837	....	......	......	......	......
1	68·3445	4530·057	·057	·784	·273	18·04	2	55·7498	4395·689	696	·286	·410	27·96
2	68·2790	4529·300	·297	·807	·490	32·38	1	54·5449	4383·928	·970	·720	·250	17·07
3S	68·2356	....	......	.....	......	....	1	54 5162	4383·650	......	....	......	......
1	67·7616	4523·337	·345	·855	·490	32·38	1	53·1281	4370·320	·356	·856	·500	34·30
3	65·2295	4494·746	......	......	......	....	1	52·9142	4368·285	·320	·840	·480	32·92
1	64·1575	4482·928	·924	·434	·490	32·88	2	51·2105	4352·272	·312	·006	·366	21·08
1	63·5802	4476·631	·631	·214	·420	28·09	3	48·3264	4325·902	......	......	......	....
2	63·5399	4476·193	......	......	......	....	2	47·8181	4321·348	·368	·992	·376	26·05
1	63·2805	4473·381	·377	·957	·420	28·10	2	47·1641	4315·529	·545	·178	·367	25·46
2	62·6605	4466·698	......	.....	......	....	3S	46·3197	....	......	......	......	......
2	59·7122	4435·639	·654	·184	·470	31·77	1	46·3442	4308·296	·296	·023	·273	18·97
1	58·9422	4427·719	·730	·420	·310	20·98	2	46·1418	4306·521	·513	·153	·360	+25·02

Weighted mean		+25·87
V_a	−25·19	
V_d	− ·14	
Curvature	− ·50	
Radial velocity		0·0

η BOÖTIS 318c.

1906. June 29. Observed by J. S. Plaskett.
G. M. T. 14h 21m Measured by J. N. Tribble.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2½	65·1913	4584·018	......	......	......	....	1½	46·8204	4383·596	......	......	......	....
2	62·3803	4550·121	·205	·766	·439	+28·93	1½	45·5865	4371·738	·806	·312	·494	29·78
2	62·3321	4549·552	......	......	......	....	1	45·4158	4370·111	·177	·856	·321	22 03
½	60·7998	4531·584	·664	·202	·462	30·59	1	45·2187	4368·238	·302	·840	·462	31·84
1½	60·5480	4528·712	......	......	......	....	¾	42·2886	4340·901	·941	·634	·307	21·20
¾	60·0766	4523·289	·377	·855	·522	34·61	1½	39·4436	4315·255	......	......	......	....
1½	57·5359	4494·635	......	......	......	....	1	38·6660	4308 394	·390	·023	·367	25·53
1½	54·2713	4459·185	......	......	......	....	3	37·0462	4294·299	......	......	......	....
1½	53·9012	4455·264	·384	·962	·422	28·40	1	35·7398	4283·122	·106	·721	·385	26·95
1	51·5610	4430·869	·985	·678	·307	20·78	1½	33·0517	4260·643	......	......	......	....
2	50·0623	4415·601	·709	·293	·416	28·25	1	28·9306	4227·475	·463	·010	·453	32·12
1½	50·0089	4415·084	......	......	......	....	1	25·2131	4198·823	·819	·403	......	+28·78
2	49·0242	4405·227	·331	·951	·380	25·87	2	22·9474	4181·919	......	......	......	....
1	46·8536	4383·917	·001	·720	·281	20·02							

Weighted mean .... + 27·55
V_a .... − 25·31
V_d .... − ·14
Curvature.............. − ·28

Radial velocity .... + 1·8

η BOÖTIS 326.

1906. July 4. Observed by J. S. Plaskett.
G. M. T. 14h 50m Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	47·9535	4321·280	·292	·992	·300	+20·97	1	62·1243	4459·686	·724	·304	·420	28·22
2	72·9821	4584·067	......	......	......	....	2	61·7085	4455·266	·300	·962	·338	22·74
1	72·0410	4572·552	·528	·156	·372	24·32	1	61·3025	4450·975	·097	·654	·443	29·81
2	70·1726	4550 127	·126	·766	·360	23 68	2	59·0672	4427·735	·743	·420	·323	21·86
2S	70·1316	....	......	......	......	....	2	57·8787	4415·645	·638	·293	·345	23·42
2	68·9985	4536·325	·325	·965	·360	23·79	2	56·8425	4405·249	·251	·951	·300	20·43
1	68·3839	4529·186	·187	·807	·380	25·15	3S	56·8102	....	......	......	......	....
3	68·3512	4528·807	......	......	......	....	2	55·8790	4395·702	·710	·286	·424	28·91
1	67·8624	4523·173	·165	·855	·310	20·55	3	54·6865	4384·041	·060	·720	·340	23·25
2	65·9783	4501·798	·786	·448	·338	22·47	2	54·6501	4383·688	......	......	......	....
3	65·3427	4494·706	......	......	......	....	2	53·4072	4371·721	·752	·312	·440	30·18
2	63·6949	4476·593	·584	·214	·370	24·75	1	53·0457	4368·273	·300	·840	·460	31·55
2	63·6582	4476·195	......	......	......	....	2	51·3477	4352·284	·308	·006	·302	20·80
2	63·3995	4473·387	·407	·957	·450	30·15	3	50·1222	4340·944	·960	·634	·326	22·49
2	62·7750	4466·648	......	......	......	....	3	48·4705	4325·922	......	......	......	....
1	62·8070	4466·982	·061	·771	·290	19·45	3	47·3080	4315·523	·523	1·78	·345	+23·94
2	62·6324	4465·118	·158	·712	·446	29·92	3S	46·4662	....	......	......	......	....

Weighted mean .... + 24·70
V_a .... − 25·68
V_d .... − ·21
Curvature.......................... − ·50

Radial velocity .... − 1·7

η BOÖTIS 333.

1906. July 6.
G. M. T. $15^h\ 0^m$

Observed by J. S. Plaskett.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
3	65·1677	4584·687	......	......	......	......	2	49·0105	4405·903	·327	·951	·376	25·60
1	64.2090	4572·978	·370	·156	·214	+14·03	2	49·9783	4415·602	......	......	......	......
2	62·3521	4550·733	·149	·766	·383	25·23	1½	46·8362	4384·534	·958	·720	.238	16·28
2	62·3108	4550·244	......	......	......	......	1	46·0199	4376·656	......	......	......	......
1½	60·7739	4532·258	·690	·202	·488	32·27	2	45·2045	4368·866	·298	·840	·458	31·43
1½	60·5228	4529·354	......	......	......	......	2	42·2765	4341·509	·949	·634	·315	21·66
2	57·5196	4495·363	......	......	......	......	1¾	39·4279	4315·792	......	......	......	......
1½	54·8062	4465·776	·200	·972	·228	15·31	2	38·6559	4308·969	·425	·023	·402	29·97
1	54·5412	4462·942	·366	·977	.389	26·15	2	37·6252	4299·954	......	......	......	......
1	54·2551	4459·893	......	......	......	......	1	37·0706	4295·148	·620	·273	·347	24·22
2	53·8852	4455·966	·390	·962	·428	22·07	2	33·0446	4261·155	......	......	......	......
1	53·4774	4451·659	·079	·597	·482	32·45	2	33·0766	4261·419	·923	·523	.400	28·14
2	51·5374	4431·472	·888	·678	·210	14·21	1¾	28·9090	4227·803	·371	·010	.361	25·59
2	51·2451	4428·473	.893	·420	·473	32·02	2	24·3115	4192·463	·103	·678	.425	+30·37
1½	51·0727	4426·719	·135	·805	·330	22·37	2	22·9368	4182·232	....	......	......	......
2	50·0457	4416·282	·702	·293	·409	27·76							

Weighted mean	+24·60	
V_a		−25·76
V_d		− ·21
Curvature		− ·28
Radial velocity		− 1·7

η BOÖTIS 366.

1906. Aug. 6.
G. M. T. $14^h\ 5^m$

Observed by W. E. Harper.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2½	65·2314	4584·018	......	......	......	......	1½	46·8746	4383·831	871	·720	·151	10·42
1	64·2565	4572·121	......	......	......	......	1½	46·8483	4383·577	......	......	......	......
2	62·4060	4549·971	.039	·766	·273	+18·00	1	45·6093	4371·677	·707	·312	·395	27·11
2	62·3706	4549·552	......	......	......	......	1½	45·2419	4368·182	·210	·840	·370	25·38
1½	60·8339	4531·583	.495	·202	.293	19·38	1	46·0709	4376·090	......	......	......	......
1½	60·5846	4528·704	......	......	......	......	1½	42·3186	4340·924	·936	·634	·302	20·85
1½	60·1077	4523·221	·307	·855	·452	29·97	1½	39·4696	4315·255	......	......	......	......
2	57·5747	4494·670	......	......	......	......	1½	38·6818	4308·308	·296	·023	·273	18·99
1	53·9251	4455·161	·247	·962	.285	20·18	2	37·0702	4294·292	......	......	......	......
1	53·5350	4451·047	·131	·597	·534	35·98	2	33·0764	4260·658	......	......	......	......
1½	54·3107	4459·249	......	......	......	......	1½	28·9385	4227·371	·349	·010	·339	24·03
1½	51·5845	4430·779	·859	·678	·181	12·25	1½	25·2344	4198·838	·830	·403	·427	28·48
2	50·0855	4415·538	·602	·293	·309	21·09	1	24·3315	4192·055	·047	·678	·369	+26·37
1½	50·0371	4415·051	......	......	......	......	2	22·9657	4181·919	......	......	......	......
2	49·0520	4405·195	·251	·951	·300	20·42							

Weighted mean	+23·28	
V_a		−23·23
V_d		− ·21
Curvature		− ·28
Radial velocity		− 0·4

η BOÖTIS 372.

1906. Aug. 8.
G. M. T. 14h 15m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	72·9730	4584·279	......	......	......	....	2	59·0301	4427·683	·683	·420	·263	17·80
2	71·4967	4566·264	·114	·726	·388	+25·33	3	57·8275	4415·472	·456	·244	·212	14·43
1	71·3535	4564·535	......	..	......	....	3	56·7962	4405·149	·149	·951	·198	13·48
2	70·6887	4556·559	·539	·202	·337	22·14	3S	56·7738	....	......	......	......	......
3	70·1445	4550·083	·083	·766	·317	20·85	2	55·8252	4395·551	·567	·286	·291	19·84
3S	70·1072	....	......	......	......	....	2	54·6369	4383·963	·995	·720	·275	18·81
2	68·9701	4536·273	·233	·965	·268	17·71	1	54·6080	4383·683	......	......	......	......
2	68·3516	4529·077	·017	·807	·210	13·90	1	53·3464	4371·570	·602	·312	·290	19.89
3	68·3336	4528·881	......	......	......	....	1	53·1912	4370·093	·125	·856	·269	18·45
1	68·0462	4525·563	·505	·295	·210	13·95	1	52·9897	4368·180	·210	·840	·370	25·38
2	67·8440	4523·237	·177	·855	·322	21·24	2	52·1188	4359·963	·979	·784	·195	13·41
2	65·9487	4501·743	·743	·431	·312	20·74	2	52·0196	4359·033	·050	·732	·318	21·87
3	65·3170	4494·693	......	......	......	....	2	51·2852	4352·180	·180	·006	·174	11·98
2	64·1450	4481·782	·806	·591	·215	14·38	3	48·4145	4325·973	......	......	......	......
3	63·6316	4476·186	......	......	......	....	2	47·1450	4314·668	·660	·353	·307	21·30
1	63·0377	4470·518	·558	·300	·258	17·28	2	48·4512	4326·302	·270	·939	·331	22·93
2	62·7485	4466·650	......	......	......	....	3S	46·3963	....	......	......	......	......
2	62·7757	4466·943	·983	·771	·212	14·22	2	44·8470	4294·632	·552	·273	·279	19·50
2	62·0833	4459·540	·588	·304	·284	19·08	2	44·8210	4294·409	......	......	......	......
1	62·0545	4459·233	......	......	......	....	2	44·1405	4288·580	·500	·134	·366	25·58
2	61·2637	4450·865	·913	·596	·317	21·33	1	42·5767	4275·360	·280	·922	·358	+25·09
2	59·7795	4435·386	·406	·184	·222	15·00							

Weighted mean	+18·89
V_a	− 22·83
V_d	− ·28
Curvature	− ·50
Radial velocity	− 4·7

η BOÖTIS 657.

1907. March 8.
G. M. T. $18^h 45^m$

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	70·1436	4550·186	....	.....	......	....	1	58·8587	4425·560	·385	·805	·420	28·43
3	70·1197	4549·902	·356	·766	·410	−27·02	3	57·8397	4415·172	·033	·293	·260	17·65
2	68·9542	4536·160	·665	·965	·300	19·86	3	56·8292	4405·001	......	......	......	....
2	68·5475	4531·415	·982	·202	·220	14·58	3	56·7987	4404·697	·601	·951	·350	23·83
1½	68·4181	4529·911	·489	·849	·360	23·86	2	55·8360	4395·127	·056	·286	·230	16·00
2	68·3585	4529·219	......	......	......	....	2	54·6789	4383·776	......	......	......	....
2	68·3380	4528·981	·557	·807	·250	16·57	2	54·6412	4333·409	·370	·720	·350	23·94
2	67·8226	4523·022	·625	·855	·230	15·25	2	53·3717	4371·145	·152	·312	·160	10·96
2	65·3575	4495·078	......	......	......	....	2	53·2120	4369·615	·636	·856	·220	15·07
2	65·3175	4494·631	·270	·550	·280	18·67	2	51·3172	4351·693	·786	·006	·220	15·14
1½	62·8052	4467·078	......	......	......	....	2	50·0839	4340·245	·364	·634	·270	18·63
2	62·6047	4464·920	·562	·772	·210	14·07	3	48·4987	4325·775	......	......	......	....
2	61·6695	4454·916	·642	·962	·320	21·54	2	47·9197	4320·558	·752	·992	·240	16·63
2	61·2555	4450·527	·257	·597	·340	22·88	3	46·4945	4307·864	......	......	......	....
2	59·0292	4427·311	·130	·420	·290	19·63	3	46·4645	4307·596	·793	·023	·230	−15·98

Weighted mean......................		−18·92
V_a	+13·75	
V_d	+ ·09	
Curvature....		− ·50
Radial velocity...		− 5·6

η BOÖTIS 670.

1907. March 20
G. M. T. $18^h 32^m$

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	72·9506	4583·964	......	......	......	....	3	56·7806	4404·929	......	......	......	....
2	71·9460	4571·690	·762	·112	·350	−22·92	3	56·7601	4404·724	·721	·951	·230	15·68
1½	70·0986	4549·552	.....	.....	......	....	2	55·7993	4395·209	.....	......	......	....
3	70·0827	4549·365	·436	·766	·330	21·74	2	54·6290	4383·769	......	......	......	....
2	68·9205	4535·721	·775	·965	·190	12·58	2	54·5986	4383·548	·520	·720	·200	13·68
1	68·5150	4531·010	·062	·202	·140	9·28	1	53·1621	4369·660	·626	·856	·230	15·78
2	68·3215	4528·772	......	...	....,.	....	2	51·2715	4351·839	·796	·006	.216	14·86
1	68·3066	4528·600	·647	·807	.160	10·61	1	50·0474	4340·514	·474	·634	·150	11·01
1	67·7847	4522·590	·635	·855	·220	14·60	3	48·4494	4325·976	......	......	......	....
1	65·3175	4494·740	......	......	.. ..	....	2	48·4195	4325·707	·659	·939	·280	19·38
1	65·2786	4494·308	·320	·550	·230	15·34	2	47·8720	4320·790	·732	·992	·260	18·00
1	62·7505	4466·699	·551	·771	·220	14·74	3	46·4482	4308·150	......	...	......	....
1	62·7368	4466·540	·592	·772	·180	12·08	3	46·4205	4307·906	·843	·023	·180	12·50
1½	62·5533	4464·583	......	......	......	....	1½	48·2000	4271·650	·570	·865	·295	20·56
2	61·6272	4454·717	·725	·962	·237	15·93	2	40·8897	4260·744	......	......	......	....
1	58·0902	4427·252	·260	·420	·160	10·83	2	40·8547	4260·455	·370	·640	·270	−18·87
3	57·7921	4415·071	·083	·293	·210	14·26							

Weighted mean..........		−15·25
V_a	+ 8.78	
V_d	+ ·04	
Curvature....		− ·50
Radial velocity		− 6·9

η BOÖTIS 691.

1907, April 3.
G. M. T. $18^h\ 02^m$

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	72·9612	4584·046	.....	.....	.....	.....	3	56·7745	4404·984	.....	.....	.....	.....
1	71·9513	4571·717	·730	·900	·170	−11·13	3	56·7572	4404·812	·761	·951	·190	13·62
1	70·6445	4556·013	·022	·202	·180	11·80	2	55·7889	4395·232	·176	·286	·110	7·50
3	70·0995	4549·546	·556	·766	·210	13·84	2	54·6189	4383·808	.....	.....	.....	.....
2	70·1085	4549·612	.....	.....	.....	.....	2	54·5876	4383·504	·440	·720	·280	19·83
1½	68·9195	4535·705	·695	·965	·270	17·87	1	53·3159	4371·275	·202	·312	·110	7·55
1	68·5217	4531·088	·072	·202	·130	8·62	1	53·1540	4369·732	·666	·856	·190	13·03
2	68·3245	4528·809	.....	.....	.....	.....	2	51·2648	4351·942	·876	·006	·130	8·96
2	67·7992	4522·765	·735	·855	·120	7·96	1½	50·0325	4340·553	·489	·634	·145	10·00
2	65·3230	4494·834	.....	.....	.....	.....	2	48·4305	4325·995	.....	.....	.....	.....
1	65·2775	4494·329	·270	·550	·280	18·67	1	47·8566	4320·846	·792	·992	·200	13·88
1	63·3106	4472·793	·737	·957	·220	14·76	2	47·2100	4315·086	·038	·178	·140	9·73
2½	62·7485	4466·737	·612	·772	·160	10·74	3	46·4200	4308·108	.....	.....	.....	.....
1½	62·5545	4464·657	.....	.....	.....	.....	2	46·4001	4307·932	·883	·023	·140	9·74
2	62·0287	4459·047	·004	·304	·300	20·16	2	40·8496	4260·662	.....	.....	.....	.....
1	61·6241	4454·755	·712	·962	·250	16·80	2	40·8220	4260·434	·420	·640	·220	15·48
2	61·2216	4450·507	·467	·597	·130	8·76	1	37·8036	4235·956	·962	·112	150	10·62
2	58·9911	4427·357	·320	·420	·100	6·77	1	37·0112	4229·664	·676	826	·150	−10·65
1½	58·8230	4425·639	·605	·805	·200	13·54	1	36·7472	4227·580	.....	.....	.....	.....
3	57·7905	4415·163	·113	·293	180	12·22							

Weighted mean .... −12·29
V_a .... + 2·59
V_d .... ·00
Curvature .... ·50

Radial velocity .... −10·2

η BOÖTIS 731.

1907. April 19.
G. M. T. $18^h\ 35^m$

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
1½	72·9712	4584·004	.....	.....	.....	.....	2	56·7843	4405·001	.001	·951	·050	+ 3·40
1	71·9874	4571·996	·106	·116	·010	− 0·65	3	56·7769	4404·927	.....	.....	.....	.....
2	70·1315	4549·777	·776	·776	·010	+ 0·66	1	55·8147	4395·409	·386	·286	·100	+ 6·83
1½	70·1200	4549·641	.....	.....	.....	.....	2	54·6220	4383·766	.....	.....	.....	.....
1½	68·9540	4535·965	·965	·965	·000	·00	1½	54·6211	4383·757	·720	·720	·000	·00
1	68·3433	4528·888	·887	·807	·080	+ 5·28	1½	53·1719	4369·837	·806	·856	·050	− 3·43
1	68·3355	4528·798	.....	.....	.....	.....	2	48·4312	4325·956	.....	.....	.....	.....
1	63·3442	4473·043	·007	·957	·050	+ 3·35	1	48·4336	4325·977	·959	·939	·020	+ 1·38
1½	62·7670	4466·826	.....	.....	.....	.....	3	46·4205	4308·075	.....	.....	.....	.....
1	62·5922	4464·952	·902	·772	·130	+ 8·74	1½	46·4160	4308·036	·033	·023	·010	+ 0·69
1	61·6492	4454·916	·892	·962	·070	− 4·72	2	40·8494	4260·646	.....	.....	.....	.....
1½	58·8439	4425·761	·755	·805	·050	− 3·38	1½	40·8433	4260·595	·590	·640	·050	− 3·50
2	57·8224	4415·399	·393	·293	·100	+ 6·80							

Weighted mean .... + 1·34
V_a .... − 4·57
V_d .... − ·11
Curvature .... − ·50

Radial velocity .... − 3·8

η BOÖTIS 739.

1907. April 26.
G. M. T. $17^h\ 30^m$

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
3	70·0827	4549·755	·796	·766	·030	+ 1·98	2	57·7755	4415·358	·373	·293	·080	+ 5·43
2	70·0699	4549·604	.....	.....	.....	.....	3	56·7328	4404·911	.....	.....	.....	.....
1½	68·9152	4536·057	·105	·965	·040	+ 2·65	3	56·7360	4404·943	·961	·951	·010	+ 0·68
1	68·4980	4531·213	·252	·202	·050	+ 3·31	2	55·7610	4395·296	·326	·286	·040	+ 2·73
2	68·2387	4528·736	.....	.....	.....	.....	2	54·5687	4383·616	.....	.....	.....	.....
1	67·7681	4522·804	·845	·855	·010	− 0·66	2	54·5705	4383·670	·750	·720	·030	+ 2·05
1	65·8880	4501·514	·548	·508	·040	+ 2·66	1	53·1335	4369·862	·926	·856	·070	+ 4·80
2	65·2791	4494·730	.....	.....	.....	.....	2	51·2440	4352·066	·126	·006	·120	+ 8·26
1	65·2665	4494·590	·620	·550	·070	+ 4·66	2	50·0165	4340·719	·774	·634	·140	+ 9·66
1	63·6012	4476·313	·334	·214	·120	+ 8·04	2	48·3872	4325·910	.....	.....	.....	.....
1½	63·5860	4476·149	.....	.....	.....	.....	2	48·3885	4325·922	·969	·939	·030	+ 2·07
1	63·2975	4473·023	·037	·957	·080	+ 5·37	1	47·8422	4321·020	·042	·992	·050	+ 3·46
2	62·7133	4466·729	.....	.....	.....	.....	3	46·3798	4308·051	.....	.....	.....	.....
2½	61·6094	4454·963	·972	·962	·010	+ 0·67	2	46·3865	4308·110	·133	·023	·110	+ 7·63
2	61·2057	4450·702	·707	·597	·110	+ 7·41	2	40·8133	4260·641	.....	.....	.....	.....
1½	58·9633	4427·425	·430	·420	·010	+ 0·67	2	40·8102	4260·612	·610	·640	·031	− 2·11

Weighted mean	+ 3·70	
V_a		− 7·58
V_d		− ·09
Curvature		− ·50
Radial velocity		− 4·5

η BOÖTIS 752.

1907. May 7.
G. M. T. $14^h\ 20^m$

Observed by }
Measured by } W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
1	73·0097	4584·071	.....	.....	.....	.....	1	61·2811	4450·747	·807	·597	·210	14·13
1½	72·0492	4572·350	·392	·112	·280	+18·31	1½	59·0410	4427·514	·570	·420	·150	10·15
2	70·1677	4549·830	·866	·776	·100	6·60	3	57·8548	4415·473	·533	·293	·240	16·30
1	70·1520	4549·640	.....	.....	.....	.....	3	56·8036	4404·951	·021	·951	·070	4·77
2	69·0077	4536·228	·286	·965	·320	21·18	3	56·7947	4404·863	.....	.....	.....	.....
1½	68·5945	4531·433	·492	·202	·290	19·20	2	55·8355	4395·380	·456	·286	·170	11·62
3	68·3596	4528·720	.....	.....	.....	.....	2	54·6312	4383·633	·720	·720	·000	·00
1	68·3767	4528·917	·987	·807	·180	11·92	2	54·6284	4383·606	.....	.....	.....	.....
1½	67·8727	4523·121	·195	·855	·340	22·54	2	53·2125	4370·014	·116	·856	·260	17·84
1	65·7679	4499·332	·399	·129	·270	17·98	1	51·3040	4352·057	·166	·006	160	11·00
1	65·3486	4494·672	.....	.....	.....	.....	1	50·0865	4340·815	·934	·634	·300	20·70
½	65·3500	4494·679	·750	·550	·200	13·34	3	48·4356	4325·827	.....	.....	.....	.....
1½	63·3679	4472·994	·057	·957	·100	6·70	1½	47·8955	4320·987	.122	·992	·130	9·00
1	62·7800	4466·663	.....	.....	.....	.....	3	46·4197	4307·917	.....	.....	.....	.....
1	62·6280	4465·038	·102	·772	·330	22·11	2	46·4370	4308·068	·223	·023	·200	+13·88
2	61·6907	4455·067	·132	·962	·170	11·44	2	40·8503	.....	.....	.....	.....	.....

Weighted mean		+13·07
V_a	−12·01	
V_d		+ ·11
Curvature	− ·50	
Radial velocity		+ 0·7

η BOÖTIS 760.

1907. May 14.
G. M. T. $17^h\ 55^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	77·0138	4586·749	......	.....	......	....	1½	60·3522	4476·077	.....	.....	......	....
1½	75·0110	4572·563	·402	·112	·290	+18·96	1	60·3978	4476·358	·438	·214	·224	14·03
1	74·0961	4566·168	·006	·726	·280	18·30	½	59·8743	4473·133	·223	·957	·266	17·84
1	72·7052	4556·546	·426	·202	·224	14·72	1½	51·9075	4425·754	·924	·608	·316	21·39
½	71·7530	4550·028	·906	·766	·140	9·22	1	48·7471	4407·805	·995	·851	·144	9·80
1½	71·7146	4549·767	......	....	......	....	3	48·1928	4404·704	.....	.....	......	....
2	68·5907	4528·772	......	.....	......	....	1	42·0610	4371·304	·632	·312	·320	+21·95
1½	68·0928	4525·481	·441	·295	·146	9·66	1½	38·5042	4352·659	......	.....	......	....
1½	67·7272	4523·072	·035	·855	·180	11·92							

Weighted mean		+15·25
V_a		−14·70
V_d..........................		− ·14
Curvature		− ·50
Radial velocity..........................		− 0·1

η BOÖTIS 764.

1907. May 20.
G. M. T. $16^h\ 25^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	76 8697	4586·673	·521	·191	·330	+21·52	1	57·5027	4459·583	·604	·304	·300	20·22
1½	76·8647	4586·638	·208	·018	·190	12·39	1	56·0608	4450·947	·967	·597	·370	24·93
1	76·5408	4584·329	·018	·618	·400	26·08	2	53·4276	4435·427	·444	·184	·260	17·57
1	76·2327	4582·137	......	.....	......	....	2	52·0857	4427·650	·666	·420	·246	16·65
2	76·0296	4580·696	.....	.....	.....	....	1½	51·8037	4426·026	·038	·608	·430	29·11
1	73·6800	4564·218	·149	·939	·210	13.75	2½	49·9630	4415·519	·523	·293	·230	15·62
1½	72·5669	4556·532	·472	·202	·270	17·76	2	49·9173	4415·260	......	.....	......	......
1	72·2842	4554·592	·537	·257	280	18·42	2	48·1222	4405 168	·171	·951	·220	15·60
1	72·0388	4552·913	·864	·594	·270	17·76	2	46·3847	4395·539	·539	·286	·253	17·25
2½	71 6337	4550·080	·046	·766	·280	18·42	1½	44·2712	4384·005	·005	·720	·285	20·14
½	71·5812	4549·791	...	.....	......	....	2	43·4159	4379·392	.....	....	......	....
1	69·5846	4536·314	·295	·965	·330	21·81	1½	41·9670	4371·648	·652	·312	·340	23·30
2	68·4979	4529·079	·077	·807	·270	17·87	2	39·7680	4360·064	·074	·784	·290	19·90
2	67 5990	4522·147	·155	·855	·300	19·89	1½	39·5791	4359·078	·086	·732	·354	24·28
2	65·3760	4508·673	·685	·455	·230	15·30	1	38·4112	4353·015	... .	......	......	....
1½	64·3050	4501·799	·818	·448	·370	24·64	2	38·2760	4352·317	·336	·006	·330	22·70
2	63·2326	4494·979	·994	·664	·330	22·01	2	36·0640	4340·994	·004	·634	·370	25·53
1	63·1922	4494·724	...	......	......	....	2	33·0691	4325·962	......	......	......	....
1½	61·1145	4481·693	·710	·400	·310	20·74	1½	33·1252	4326·247	·239	·939	·300	20·76
2	60·2770	4476·506	·524	·214	·310	20·74	2	32·1120	4321·238	·226	·992	·234	16·20
1½	59·7526	4473·277	·297	·957	·340	22·78	1½	30·9360	4315·473	·458	·178	·280	19·40
1	59·1947	4469·856	·876	·520	·356	23·85	2	29·4608	4308·313	·293	·023	·270	18·72
1	58·6782	4466·704	.....	......	......	. ...	2	29·4193	4308·113	......	......	....,..	....
½	58·4205	4465·137	·162	·772	·390	26·13	2	25·2745	4288·450	·424	·134	·290	+20·27

Weighted mean........................		+20·26
V_a	−16·77	
V_d................	− ·10	
Curvature...........	− ·50	
Radial velocity....		+ 2·91

η BOÖTIS 769.

1907. May 22.
G. M. T. 16h 51m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	72·3751	4554·627	·507	·257	·250	+16·47	2	57·5897	4459·591	·644	·304	·340	22·91
1½	72·1497	4553·084	·964	·594	·370	24·38	1	56·8622	4455·219	·272	·962	·310	20·89
3	71·7156	4550·122	·006	·766	·240	16·00	1½	52·1741	4427·666	·720	·420	·300	20·31
1½	71·6651	4549·777	......	......	......	......	2	50·0535	4415·548	·598	·293	·305	20·70
2	69·6739	4536·338	·255	·965	·290	19·20	2	49·9998	4415·244	......	......	......	......
2	68·5989	4529·180	·107	·807	·300	19·86	1½	48·2070	4405·164	·211	·951	·260	17·73
2	68·5477	4528·841	......	......	......	......	2	48·1555	4404·877	......	......	......	......
2	67·6870	4523·161	·105	·855	·250	16·55	3	43·4978	4379·372	......	......	......	......
1	66·5626	4515·805	·768	·508	·260	17·10	1½	42·0517	4371·654	·702	·312	·390	26·75
1	66·4065	4514·789	·736	·476	·260	17·26	1	41·7560	4370·074	·116	·856	·260	17·85
2	63·3054	4494·898	·894	·664	·230	15·34	1	41·3860	4368·116	·160	·840	·320	21·95
1½	63·2838	4494·762	......	......	......	......	2	38·4841	4352·949	......	......	......	......
1	60·3530	4476·447	·484	·214	·270	18·09	1½	38·3357	4352·182	·246	·006	·240	16.54
2	59·8426	4473·304	·337	·957	.380	25·46	1	32·1922	4321·209	·292	·992	·300	20·76
1½	59·2733	4469·814	......	......	......	......	2	30·9890	4315·312	·408	·178	·230	+15·92
2	58·4874	4465·024	·062	·772	·290	19·48	2	30·9743	4315·192	......	......	......	......

Weighted mean........................		+19·46
V_a....................	−17·43	
V_d....................	− ·14	
Curvature................	− ·50	
Radial velocity........................		+ 1·4

η BOÖTIS 774.

1907. May 23.
G. M. T. 14h 08m

Observed by W. E. Harper.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
1	73·3722	4871·911	......	......	......	......	¾	42·5701	4299·750	·726	·277	·247	17 23
2S	73·5307	4875·673	......	......	......	......	1½	40·6425	4272·077	·053	·760	·293	20·56
1½	72·9489	4861·911	·803	·527	·276	+17·03	1½	40·4252	4269·004	......	......	......	......
2	56·7439	4528·932	......	......	......	......	¾	39·8399	4260·771	·747	·640	·107	7·53
1	57·9013	4549·900	......	......	......	......	2	36·5802	4216·114	·102	·897	·105	7·47
1	57·9293	4550·311	·119	·766	·353	23 26	2½	36·1574	4210·469	......	......	......	......
1	52·5304	4455·601	·565	·962	·603	40·65	1½	35·5747	4202·733	·733	·161	·272	17·51
2S	48·8521	4395·386	......	......	......	......	1	35·2917	4198·999	·999	·494	·505	36·07
2½	49·1726	4400·502	......	......	......	......	1½	S35·5345	4202·202	......	......	......	......
1	49·4586	4405·090	·982	·908	·074	5·04	1	30·0803	4132·687	·767	·212	·555	40·29
1	49·2138	4401·162	·162	·138	·424	28·87	1	29·3427	4123·660	......	......	......	......
1½	45·3618	4341·187	......	......	......	......	¾	28·9702	4119·134	·234	·844	·390	28·38
1	45·3471	4340·964	·948	·634	·314	21·82	1	27·5532	4102·114	·218	·000	·218	15·94
1	43·1330	4307·974	·950	·932	·018	1·25	¾	26·7817	4092·974	·078	·626	·452	33·13
2	42·5531	4299·503	......	......	......	......							

Weighted mean........................		+21·29
V_a....................	−17·73	
V_d....................	− ·03	
Curvature................	− ·28	
Radial velocity........................		+ 3·2

η BOÖTIS 779.

1907. May 24.
G. M. T. 15h 01m

Observed by J. S. Plaskett.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	58·0640	4549·549	......	......	......	....	1½	40·8102	4271·728	·872	·760	·112	7·85
1	58·0817	4549·873	·001	·766	·235	+15·46	2	37·6159	4227·429	......	......	......	....
2	50·2577	4415·039	.....	....	......	....	1½	37·5998	4227·211	·331	·904	·427	30·27
1	50·2836	4415·459	·595	·293	302	20·54	1	36·7625	4215·917	·021	·897	·124	8·82
2½	49·6247	4404·812	......	......	......	....	1	35·4747	4198 795	·907	·403	·505	35·99
1	49·6384	4405·032	·216	·951	·265	18·05	1	33·0716	4167·618	·706	·438	·268	19·27
1½	46·3206	4352·943	.....	.....	......	....	2	31·1734	4143·682	......	...	......	......
1	46·2767	4352·270	·454	·006	·448	30·86	1	31·1972	4143·979	·051	·914	·137	9·91
1	45·5212	4340·763	·939	·634	·305	20·95	1	29·9036	4127·997	·053	·862	·191	+13·88
2½	40·8015	4271·605	.....	...	......	....	2	28·0030	4104·992	......	.....	......	......

Weighted mean.................... +18·15
V_a .... −18·04
V_d .... − ·21
Curvature .... − ·28

Radial velocity................................ − 0·3

η BOÖTIS 793.

1907. May 29.
G. M. T. 16h 46m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
1	61·2267	4613·852	......	.....	.....	....	2	47·7600	4379·416	......	......	......	......
2	61·2151	4613·629	·755	·465	·290	+18·76	1½	47·0501	4368·323	·307	·840	·467	32·04
2	60·7801	4605·266	·437	·997	·440	28·51	1	45·2664	4340 948	·954	·634	·320	22·08
2	60·5522	4600·908	·076	·524	·552	35·76	2	44·2835	4326·157	·174	·694	·480	33·22
2	59·7843	4586·340	. .	......	......	....	1	43·0857	4308·409	·443	·023	·420	29·15
1	59·6576	4583·954	·150	·796	·354	23·08	2	43·0609	4308·044	...	......	......	......
2	57·8364	4550·173	·308	·766	·542	35·72	1½	40·5687	4272·055	·090	·760	·330	23·20
2	56·6522	4528·720	......	......	......	....	2	39·7598	4260·611	.....	......	......	......
2	52·7172	4460·183	......	....	.. ...	....	2	39·7727	4260·835	861	·546	·315	22·14
2	50·0340	4415 682	·783	·293	·490	33·37	1	37·8163	4233·751	·768	·328	·440	31·15
2	49·3967	4405·432	·471	·951	·520	35·46	1½	36·5183	4216·158	·167	·897	·270	+19·17
3	48·7702	4395·400	.....	......	......	....	2	35·4705	4202·202	......	......	......	......
2	48·8021	4395·909	·896	·286	·610	41·66							

Weighted mean.......................... +29·03
V_a .... −19·56
V_d .... − ·15
Curvature .... − ·50

Radial velocity.......................... + 8·8

η BOÖTIS 797.

1907. May 31.
G. M. T. $14^h\ 54^m$

Observed by J. S. PLASKETT.
Measured by C. R. WESTLAND.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9660	....	....	....	2	43·0819	·0711	·0208	21·20
2	72·8399	·8829	·0181	+26·26	2	40·5728	·5560	·0301	29·86
2	72·4047	....	....	....	2	39·7707	·7517	·0249	24·50
2	57·8365	·8410	·0142	17·10	2	39·7551	....	....	....
2	57·8055	....	....	....	1½	37·3501	·3227	·0339	32·51
2	50·0029	....	....	....	2	36·5196	·4893	·0271	25·77
1½	49·3909	·3937	·0263	28·72	1½	35·4969	·4631	·0355	33·40
1	48·7877	·7855	·0215	23·53	2	35·4641	....	....	....
2	48·7722	....	....	....	1½	31·6032	·5560	·0151	13·65
1	47·0514	·0483	·0352	37·45	2	30·1736	....	....	....
2	45·2777	....	....	....	2	27·3086	....	....	....
1½	45·2658	·2617	·0230	23·56	1½	26·7220	·6579	·0296	+25·48
2	43·5481	....	....	....	2	26·7084	....	....	....

Weighted mean		+25·50
V_a	−20·10	
V_d	− ·05	
Curvature	− ·28	
Radial velocity		+ 5·1

η BOÖTIS 812.

1907. June 10.
G. M. T. $14^h\ 10^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement.	Velocity.
2	72·8854	4864·874	......	......	......	....	2	43·0742	4308·544	·560	·023	·537	37·37
2	72·7643	4862·010	·047	·527	·520	+32·08	2	42·0980	4294·278	......	......	......	....
1½	57·8020	4550·549	·386	·766	·620	40·85	1	41·3355	4283·269	·285	·722	·563	39·00
2	57·7617	4549·811	......	......	......	....	2	40·5595	4272·188	·204	·760	·444	31·12
2	53·0646	4466·768	......	......	......	....	1½	39·7652	4260·968	·987	·527	·460	32·34
1½	52·9887	4465·474	·412	·772	·640	42·94	2	39·7401	4260·615	......	......	......	....
2	52·4071	4455·617	·562	·962	·600	40·32	2	39·0561	4251·055	·067	·643	·424	29·89
2	52·2073	4452·249	......	......	......	....	1½	37·8028	4233·770	·778	·462	·316	22·37
2	49·3623	4405·394	·391	·908	·483	32·84	2	37·3322	4227·356	·364	·010	·354	25·06
2	48·7661	4395·825	·826	·426	·400	27·28	1½	35·2093	4198·927	·924	·494	·430	30·70
2	45·9963	4352·404	·412	·957	·455	31·44	2	34·6878	4192·067	·068	·678	·390	27·70
2	45·2575	4341·177	......	......	......	....	2	31·9631	4156·989	·989	·623	·366	26·35
2	45·2518	4341·089	·099	·634	·465	32·08	2	30·9498	4144·262	·262	·928	·334	+24·11
1½	44·2697	4326·286	·299	·939	·360	24·91	2	27·3112	4099·919	......	......	......	....

Weighted mean		+30·09
V_a	−22.52	
V_d	− ·04	
Curvature	− ·28	
Radial velocity		+ 7·2

η BOÖTIS 868.

1907. June 21. G. M. T. $14^h\ 27^m$

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement.	Velocity.
3	59·4917	4580·498	......	......	......	....	2	45·2755	4341·084	......	......	......	....
2	59·0511	4572·262	·308	·758	·550	+35·91	2	44·2785	4326·119	·199	·939	·260	18·00
3	57·8496	4550·094	·156	·766	·390	25·70	2	43·5520	4315·347	·448	·178	·270	18·71
1½	57·8233	4549·613	......	....	......	....	2	42·1004	4294·152	....	......	......	....
3	56·6631	4528·612	......	......	......	....	1	40·5592	4272·120	·270	·760	·510	35·70
1½	56·3594	4523·178	·345	·985	·360	23·80	2	39·7555	4260·816	·947	·527	·420	29·53
1½	53·1004	4466·545	......	.....	......	....	2	39·7351	4260·530	......	......	.....	....
2	50·9767	4430·966	·138	·678	·460	31·14	1	36·4997	4216·283	·323	·897	·426	30·12
2	50·0392	4415·661	·824	·354	·470	31·96	1½	35·4821	4202·764	·768	·198	·570	40·58
2	50·0050	4415·107	......	......	......	....	2	35·4386	4202·190	......	......	......	....
2	49·4000	4405·349	·498	·908	·590	40.18	1	34·6655	4192·048	·038	·678	·360	25·74
2	48·7697	4395·275	......	....	......	....	1	32·7961	4167·952	·902	·617	·285	20·49
2	47·2771	4371·789	·893	·343	·550	37·62	2	30·1393	4134·712	.....	.....	......	....
1½	47·1802	4370·281	·387	·867	·520	35·56	1	29·9750	4132·694	·592	·212	·380	+27·40

Weighted mean........................ +29·89
V_a .... −24·46
V_d .... − ·11
Curvature.............. − ·28

Radial velocity.................... + 5·0

η BOÖTIS 891.

1907. June 27. G. M. T. $14^h\ 55^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·7980	·8200	·0173	+20·87	2	40·5817	·5833	·0324	32·24
1	57·7762	....	....	....	2	39·7320	·7845	·0300	29·61
2	49·9624	. .. ...	....	....	2	39·7102	....	....	... .
1	49·3500	·3936	·0279	30·55	1	37·3052	·3613	.0363	35·57
½	48·7547	·7987	·0160	17·41	1	36·4711	·5275	.0262	25·41
2	48·7277	....	....	....	1	35·4539	·5119	.0414	39·54
1½	47·0142	·0602	·0391	41·25	2	35·4170	.. ..	....	....
2	45·2395	....	. ...	....	1	31 5636	·6300	·0313	28·17
1½	45·2339	·2809	·0322	33·71	2	30·1178	....	.. . .	....
2	43·5028	....	....	....	2	27·2449	....	....	....
2	43·0515	·1009	·0377	38·52	1½	26·6595	·7335	·0272	+24·13
2	42·0723	... .	....	....	2	26·6400	....	....	....

Weighted mean........... .... +30·53
V_a .. .. −24·37
V_d .... − ·17
Curvature.... .... ·28

Radial velocity..................... + 5·7

η BOÖTIS 918.

1907. July 8. G. M. T. $15^h\ 09^m$

Observed by J. S. PLASKETT. Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8099	....	....	....	1	44·2898	·2798	·0206	21.27
1	57·8572	·8620	·0352	+42·38	1	43·5460	....	....	....
1	56·6611	....	....	....	1	43·0888	·0758	·0255	25·98
1	55·1526	·1576	·0324	37·77	1	41·3060	....	....	....
1½	54·7393	....	....	....	1	40·5805	·5615	·0356	35·31
1	50·0034	....	....	....	1	39·7823	·7613	·0264	25·97
1	50·0306	·0296	·0205	22·55	1	37·9860	....	....	....
1	49·4064	·4034	·0360	39·31	1	37·3568	·3308	·0180	46·04
1	49·1127	....	....	....	1½	36·5317	·5047	·0425	40·41
1	48·8040	·8020	·0292	31·68	1	35·4581	....	....	....
1½	48·7675	....	....	....	1	35·2228	·1928	·0438	41·08
1	46·0327	·0257	·0385	40·40	1	31·8048	·7713	·0232	+21·01
1	45·2824	·2744	·0437	45·62	1	30·9164	....	....	....
1	45·2825	....	....	....					

Weighted mean		+34·45
V_a	−25·79	
V_d	− ·24	
Curvature	− ·28	
Radial velocity		+ 8·1

η BOÖTIS 918.*

1907. July 8. G. M. T. $15^h\ 09^m$

Observed by J. S. PLASKETT. Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	59·0510	....	....	....	2	44·3211	·2820	·0228	23·55
1	59·0784	·0634	·0227	+27·74	2	43·5749	....	....	....
2	57·8689	·8520	·0252	30·34	2	43·1211	·0790	·0327	33·32
2	57·8388	....	....	....	2	41·8827	·8380	....	....
1	56·8542	·8352	·0244	29·04	2	41·3385	....	....	....
2	56·6862	....	....	....	2	40·6093	·5590	·0331	32·83
1	55·1704	·1464	·0212	24·72	2	39·8204	·1694	·0345	33·95
2	54·0562	....	....	....	1½	39·7879	....	....	....
1½	52·8790	·8510	·0206	23·40	2	39·1058	·0533	·0370	36·11
2	52·4827	·4547	·0399	45·13	2	38·0112	....	....	....
2	52·2770	....	....	....	2	37·3845	·3295	·0407	39·03
2	50·0586	·0280	·0179	19·69	2	36·5511	·4940	·0318	30·24
2	49·4332	·4012	·0350	38·22	2	35·4884	....	....	....
2	48·8006	....	....	....	1	35·5290	·4706	·0430	40·46
2	45·3140	....	....	....	1½	35·2561	·1973	·0483	+45·06
2	45·3180	·2800	·0413	43·12					

Weighted mean		+33·11
V_a	−25·80	
V_d	− ·24	
Curvature	− ·28	
Radial velocity		+ 6·8

*Check measurement.

η BOÖTIS 950.

1907. July 18.
G. M. T. 13h 57m

Observed by J. N. TRIBBLE.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·7949	....	....	....	1½	43·5484	·5524	·0192	19.68
1	59·0552	·0672	·0265	+32·36	2	43·0820	·0852	·0451	45·95
1½	57·8347	·8427	·0160	19·26	1½	42·1019	....	....	....
1½	57·8138	....	....	....	2	40·5663	·5655	·0396	39·28
2	53·0966	....	....	....	2	39·7395	....	....	....
1½	52·8357	·8490	·0186	21·13	1	39·7719	·7700	·0351	34.54
2	52·4416	·4546	·0398	45·01	1	39·0430	·0385	·0222	21·67
1½	50·0253	·0343	·0241	26·51	2	37·3630	....	....	....
1	49·3917	·3997	·0331	36·14	1	37·3251	·3195	·0307	29·44
1½	48·7944	·8010	·0282	30·79	1	36·5090	·5020	·0398	37·85
2	48·7650	....	....	....	3	35·4418	....	....	....
2	45·2671	....	....	....	1	35·4710	·4595	·0319	30·02
½	45·2590	·2654	·0267	27·87	1	35·1990	·1875	·0385	+35·92

Weighted mean........................	+31·38
V_a........................	−25·61
V_d........................	− ·20
Curvature..................	− ·28
Radial velocity........................	+ 5·3

η BOÖTIS 950.*

1907. July 18.
G. M. T. 13h 57m

Observed by J. N. TRIBBLE.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	59·8053	....	....	....	1	43·0955	·0835	·0332	33·82
1	59·0690	·0730	·0323	+39·43	1	42·1179	....	....	....
1	57·8528	·8563	·0295	35·51	1½	40·5776	·5621	·0362	35.91
1	57·0777	·0807	·0139	16·58	1	39·7823	·7653	·0304	29·91
1½	56·6654	....	....	....	1	38·0089	·9889	·0278	26·93
1	53·1105	....	....	....	1	37·9769	....	....	....
1	52·8502	·8512	0·208	23·62	1	37·8012	·7822	·0177	17·06
1	52·4460	·4470	0·322	36·41	1	36·5180	·4960	·0338	32·04
1	45·2830	....	....	....	1	35·4775	·4535	·0259	+24·37
1	43·5729	·5619	·0287	29·43	1	35·4548	....	....	....

Weighted mean........................	+29·23
V_a........................	−25·61
V_d........................	− ·20
Curvature..................	− ·28
Radial velocity........................	+ 3·1

*Check measurement.

η BOÖTIS 972

1907. Aug. 1
G. M. T. 13ʰ 39ᵐ

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8125	....	....	....	1	47·2717	·2733	·0315	33·55
1	59·0699	·0660	·0253	+30·89	1	47·1677	·1693	·0225	23·96
2	57·8529	·8497	·0229	27·57	1	47·0555	·0571	·0409	43·56
2	57·8249	....	....	....	2	45·2721	....	....	....
2	56·6666	....	....	....	1½	45·2731	·2751	·0364	38·00
1	56·3701	·3709	·0347	41·05	2	43·5334	....	....	....
1	55·1626	·1642	·0390	45·47	1	43·0770	·0795	·0332	33·90
2	54·0291	....	....	....	2	40·5588	·5580	·0321	31·84
1½	52·8504	·8494	·0190	21·58	1½	39·7640	·7620	·0352	34·64
1	52·4609	·4600	·0452	51·12	2	39·7388	....	....	....
2	52·2516	....	....	....	2	37·9622	....	....	....
1	50·0488	·0488	·0387	42·57	2	37·3332	·3284	·0396	37·97
1½	49·4090	·4048	·0386	42·57	2	36·5021	·4960	·0338	+32·14
2	48·7684	....	....	....	2	35·4334	....	....	....

Weighted mean.........................		+36·02
V_a	−24·14	
V_d	− ·24	
Curvature...............	− ·28	
Radial velocity....................		+ 11·4

η BOOTIS 990.

1907. Aug. 7.
G. M. T. 13ʰ 58ᵐ

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions	Velocity.
1	77·5311	·3820	·0765	+34·73	2	68·8751	....	....	....
2	77·5065	....	....	....	1½	68·0457	·9557	·0875	37·45
1	77·2249	·0775	·0838	37·88	2	67·6516	·5636	·0768	32·87
1½	75·4840	·3450	·0687	30·91	2	64·6597	·5717	·0641	26·92
2	75·3861	....	....	....	2	61·4950	....	....	....
1½	74·5448	·4108	·0755	33·75	1½	60·5500	·5045	·0777	31·62
2	73·1143	·9873	·0597	26·45	2	58·9771	·9411	·0833	33·57
2	72·8337	·7101	·0719	31·71	1	58·6538	·6200	·0878	35·38
3	72·1565	·0350	·0677	29·79	2	56·4377	....	....	....
2	72·0721	....	....	....	1	50·0635	·0820	·0726	27·66
2	70·0758	·9700	·0879	38·15	1½	48·1930	·2266	·0853	+32·07
2	69·3246	·2233	·0691	29·78	2	46·3541	....	....	....
2	68·9702	·8732	·0867	37·37					

Weighted mean.........................		+32·66
V_a	−23·09	
V_d	− ·28	
Curvature...............	− ·28	
Radial velocity....................		+ 9.0

η BOÖTIS 1231.

1908. Jan. 14.
G. M. T. 22h 00m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	57·8434	....	....	....	1½	44·2401	·2266	·0326	33·67
2	57·8277	·8047	·0221	—26·61	2	41·3012	....	....	....
1½	54·7647	....	....	....	2	40·5147	·5000	·0259	25·69
2	53·1290	....	....	....	2	39·7496	....	....	....
1	52·8248	·8048	·0256	29·08	2	39·7099	·6959	·0309	30·40
2	52·3986	·3790	·0358	40·49	1½	39·0059	·9925	·0238	23·23
2	52·2705	....	....	....	2	37·9716	....	....	....
2	49·9963	·9788	·0313	34·43	2	37·2765	·2630	·0258	24·74
1½	49·3502	·3340	·0334	36·47	1½	36·4496	·4350	·0272	25·87
2	48·7851	....	....	....	2	35·4474	....	....	....
1½	48·7630	·7470	·0258	28·00	1½	35·4212	·4043	·0233	21·92
2	45·2867	....	....	....	1½	35·1325	·1150	·0340	–31·72
1½	45·2195	·2060	·0327	34·14					

Weighted mean.................... –29·76
V_a .... +26·58
V_d .... + ·12
Curvature .... – ·28

Radial velocity.................... – 3·3

η BOÖTIS 1231.*

1908. Jan. 14.
G. M. T. 22h 00m

Observed by W. E. HARPER.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8174	....	....	....	1	44·2521	....	....	....
1	57·8144	·8084	·0182	–21·91	1	41·2816	....	....	....
1	56·6735	....	....	....	1	40·4982	5032	·0227	22·51
1	53·1182	....	....	....	1	39·7312	....	....	....
1	52·8153	·8133	·0171	19·42	2	39·6870	·6915	·0353	34·73
1½	52·3882	·3872	·0276	31·21	1½	37·9558	....	....	....
2	52·2605	....	....	....	1	37·2517	·2567	·0321	33·66
1	50·0076	....	....	....	1	36·4308	.4358	·0264	25·00
2	49·9827	·9847	·0254	27·94	2	35·4251	....	....	....
1	49·3633	....	....	....	1	35·3991	·4041	·0264	24·84
1	49·3360	·3390	·0272	29·70	1	30·8692	....	....	....
1	49·1028	....	....	....	1	30.8499	·8543	·0213	–19·12
1	48·7675	....	....	....	1	29·9064	....	....	....
1	48·7445	·7485	·0155	16·81					

Weighted mean.......... –25·62
V_a .... +26·58
V_d .... + ·12
Curvature .... – ·28

Radial velocity.................. + 0·6

*Check measurement.

η BOÖTIS 1294.

1908. Jan. 27.
G. M. T. $20^h\ 12^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·7049	......	......	......	2	60·2453	·2668	·0714	29·34
2	76·3139	·3760	·0487	−22·25	2	59·7232	·7437	·0627	25·11
2	74·9780	......	......	......	2	58·3645	·3830	·0767	31·14
2	74·9412	·9966	·0686	31·07	2	57·4642	·4818	·0701	28·32
2	74·0085	·0615	·0691	31·16	2	56·3435	......	......	......
2	73·3760	......	......	......	2	56·7436	·7596	·0669	26·90
2	72·6176	·6656	·0690	30·77	2	56·0215	·0370	·0559	22·36
1½	71·7327	......	......	......	1	50·9975	......	......	......
3	71·6719	·7194	·0628	27·88	2	49·9284	·9324	·0677	26·00
2	69·6070	·6495	·0647	28·27	2	48·0797	·0787	·0806	30·63
2	68·8730	·9130	·0794	34·46	2	46·4398	......	......	......
2	68·5172	·5572	·0705	30·60	2	46·3377	·3310	·0839	31·46
2	68·5312	......	......	......	2	38·2531	·2267	·0794	28·34
2	67·6069	·6434	·0735	31·75	2	36·2270	......	......	......
2	64·2811	·3091	·0754	31·82	2	36·0357	·0027	·0878	30·90
2	61·3235	......	......	......	2	33·1311	·0940	·0779	−26·87

Weighted mean		−29.00
V_a	+25·27	
V_d	+ ·16	
Curvature		− ·28
Radial velocity		− 3·8

η BOÖTIS 1307.

1908. Jan. 29.
G. M. T. $21^h\ 14^m$

Observed by J. S. Plaskett.
Measured by C. R. Westland.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·7556	......	......	......	2	59·7720	·7402	·0662	27·12
1½	76·3539	·3649	·0598	−27·37	2	58·4380	·4030	·0567	23·02
2	75·0276	......	......	......	2	57·5179	·4802	·0715	28·86
2	74·9901	·9980	·0660	29·92	2	56·8023	·7628	·0637	25·59
2	74·0588	·0640	·0666	30·02	2	56·3977	......	......	......
2	73·4219	......	......	......	1	56·0711	·0300	·0629	25·15
2	72·6605	·6620	·0726	32·41	2	50·0571	......	......	......
3	71·7218	·7208	·0614	27·24	2	49·9803	·9258	·0851	32·70
2	69·6614	·6552	·0590	25·81	2	48·1479	·0864	·0685	26·01
2	68·9241	·9159	·0765	33·31	2	46·4998	......	......	......
3	68·5710	·5620	·0657	28·53	2	46·4076	·3415	·0734	27·56
2	68·6280	......	......	......	2	38·3121	·2251	·0810	28·88
2	67·6542	·6427	·0742	32·03	2	36·2864	......	......	......
2	64·3451	·3251	·0594	25·08	2	36·1037	·0107	·0798	28·06
2	61·3704	......	......	......	2	33·1978	·0938	·0781	−26·96
1½	60·2939	·2634	·0748	30·75	2	33·2792	......	......	......

Weighted mean		−28·32
V_a	+24·95	
V_d	+ ·13	
Curvature		− ·28
Radial velocity		− 3·5

η BOÖTIS 1332.

Feb. 17. 1908.
G. M. T. 22h 30m

Observed by J. S. Plaskett.
Measured by C. R. Westland.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·7212	...	...	...	2	58·3842	·3982	·0615	24·97
2	76·3188	·3628	·0619	−28·33	2	57·4824	·4954	·0565	22·80
2	74·9946	...	...	...	2	56·7485	·7600	·0665	26·71
2	74·9565	·9982	·0658	29·83	2	56·3452	...	...	...
2	74·0249	·0649	·0657	29·61	1	56·0291	·0393	·0536	21·43
2	73·3885	...	...	...	2	53·4001	·4061	·0624	24·52
2	72·6378	·6756	·0590	26·34	2	49·0003	...	...	...
3	71·6874	·7236	·0586	26·00	2	49·9357	·9359	·0750	28·82
2	69·6200	·6528	·0614	26·86	2	48·0881	·0853	·0696	26·43
2	68·8936	·9251	·0673	29·30	2	46·4381	...	...	...
3	68·5431	·5741	·0536	23·18	2	46·3480	·3422	·0727	27·30
2	68·5930	...	...	...	2	38·2430	·2240	·0821	29·28
3	67·6210	·6505	·0664	28·66	2	36·2164	...	...	...
2	64·2952	·3192	·0653	27·57	2	36·0427	·0202	·0703	24·72
2	61·3281	...	...	...	2	33·1294	·1019	·0700	−24·16
2	60·2510	·2682	·0700	28·78	2	33·2010	...	...	...
2	59·7464	·7629	·0435	17·82					

Weighted mean		−25·21
V_a	+20·45	
V_d	+ ·12	
Curvature		− ·28
Radial velocity		− 5·2

η BOÖTIS 1357.

1908. Feb. 24.
G. M. T. 19h 06m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·7176	...	...	...	½	67·6130	·6450	·0719	30·99
1	76·3250	·3710	·0537	−24·59	½	63·2135	·2395	·0700	29·33
½	74·9671	·0101	·0539	24·42	2	61·3207	...	...	...
2	73·3845	...	...	...	1	60·2534	·2750	·0632	25·97
½	72·1053	·1450	·0562	25·06	½	58·3903	·4073	·0524	21·27
1	71·6970	·7365	·0457	20·34	2	56·3395	...	...	...
2	71·1225	...	...	...	½	56·0048	·0208	·0721	28·84
2	68·5883	...	...	...	½	52·0625	·0730	·0528	−20·59
½	68·5422	·5762	·0515	22·35	2	49·9913	...	...	...
½	67·9892	·0212	·0683	29·44					

Weighted mean		−25·27
V_a	+18·26	
V_d	+ ·16	
Curvature		− ·28
Radial velocity		− 7·1

η BOÖTIS 1446.

1908. March 30.
G. M. T. $21^h\ 52^m$

Observed by } W. E. HARPER.
Measured by }

Region.	Settings I.		Difference in Revolutions.	Settings II.		Difference in Revolutions.	Mean Difference	Velocity.
	Star.	Comparison.		Star.	Comparison.			
4	·395	·424	·029	·350	·324	·026	·275	−12·88
5	·410	·435	·025	·336	·314	·022	·235	10·57
6	·411	·437	·026	·346	·306	·040	·280	12·29
7	·417	·446	·029	·330	·321	·009	·190	8·15
8	·441	·465	·024	·317	·296	·021	·225	9·43
9	·450	·471	·021	·320	·290	·030	·255	10·45
10	·435	·475	·040	·304	·276	·028	·340	−13·60

Standard............ + ·33
Weighted mean.................. −10·72
V_a .... + 3·98
V_d .... − ·25

Radial velocity.................. − 7·0

η BOÖTIS 1446.*

1908. Mar. 30.
G. M. T. $21^h\ 52^m$

Observed by W. E. HARPER.
Measured by C. R. WESTLAND.

W	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	75·0031	....	....	....	2	58·3770	·4406	·0191	7·75
2	75·0052	·0377	·0263	−11·92	2	57·4580	·5231	·0288	11·62
2	74·0795	·1152	·0154	6·94	2	56·7254	·7917	·0348	13·98
2	73·3860	....	....	....	2	56·2921	....	....	....
2	72·6643	·7044	·0302	13·48	1	56·0050	·0732	·0197	7·88
3	71·7097	·7522	·0300	13·31	2	49·9236	....	....	....
2	68·9128	·9623	·0301	13·10	1	49·8982	·9763	·0346	13·20
2	68·5557	·6061	·0216	9·38	2	48·0465	·1272	·0321	12·19
2	68·5760	....	....	....	2	46·3500	....	....	....
2	67·6457	·6970	·0199	9·32	2	46·3083	·3908	·0241	9·05
2	61·2856	....	....	....	3	38·1702	·2679	·0382	−13·62
2	60·2494	·3100	·0282	11·59	2	36·0923	....	....	....
2	59·7264	·7878	·0186	7·62					

Weighted mean.................. −10·94
V_a .... + 3·98
V_d .... − ·25
Curvature...................... − ·28

Radial velocity...................... − 7·5

*Check measurement.

η BOÖTIS 1446.*

1908. March 30.
G. M. T. $21^h\ 52^m$

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	76·7922	….	….	….	1	59.7825	·7820	·0244	10.00
1	76·4392	·4142	·0105	−4·80	1	58·4374	·4384	·0213	8·64
1	75·0585	….	….	….	1	57·5302	·5322	.0197	7·95
1	75·0715	·0465	·0175	7·92	1	56·7981	·8011	·0154	6·19
2	73·4509	….	….	….	1	56·3536	….	….	….
1	72·7325	·7074	·0272	12·13	2	49·9915	….	….	….
2	71·7755	·7505	·0317	14·07	1	49·9582	·9712	·0289	11·09
1	68·9752	·9542	·0382	16·62	1	48 1122	·1272	·0321	12·19
1	68·6257	·6047	·0230	9·98	2	46 4180	….	….	….
2	68·6416	….	….	….	1	46·3655	·3845	·0304	11·43
1	67·7025	·6945	·0224	9·67	1	38·2275	·2595	·0466	−16·63
1	61·3480	….	….	….	1	36·1572	….	….	….
1	60·3231	·3211	·0171	7·02					

Weighted mean.................. −10·39
V_a .... +3·98
V_d .... − ·25
Curvature................. − ·28

Radial velocity................ − 6·9

*Check measurement.

η BOÖTIS 1513.

1908. May 4.
G. M. T. $18^h\ 13^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	75·1160	….	….	….	2	63·3747	….	….	….
2	74·2116	·2076	·0087	+ 3·91	1	63·3747	·3635	·0061	2·55
2	73·4946	….	….	….	1	60·3917	·3785	·0109	4·47
2	72·8120	·8070	·0080	3·55	1	59·8668	·8533	·0189	7·71
1	72·5446	·5394	….	….	2	58·8243	….	….	….
2	72·2822	·2770	·0131	5·82	2	58·5330	·5188	·0112	4·54
2	71·8622	·8567	·0128	5·68	1	56·8700	·8540	·0081	3·24
1½	69·7922	·7857	·0155	6·76	2	56·3934	….	….	….
1	69·0562	·0492	….	….	2	53·9788	….	….	….
1	68·7040	·6967	·0159	6·92	1	52·1672	·1482	·0164	6·36
2	68·6835	….	….	….	1	48·1835	·1620	0087	+ 3·30
1	67·7903	·7823	·0150	6·46	2	46·4436	….	….	….
1	65·5445	·5350	·0056	2.37					

Weighted mean............ + 4·91
V_a .... −11·19
V_d .... − ·17
Curvature.................. − ·28

Radial velocity................... − 6·7

η BOÖTIS 1557.

1908. May 23.
G. M. T. $16^h\ 00^m$

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	76·9548	....	....	....	1	68·2353	·2063	·0138	5·93
1	76·9700	·9334	·0152	+ 6·93	2	67·4948	·4461	·0085	3·63
1	76·6302	·5937	·0200	9·10	1	63·4283	....	....	....
1	75·2687	·2326	·0273	12·31	1	59·9277	·8962	·0339	13·79
2	75·2128	....	....	....	1	59·3672	·3358	·0362	14·69
2	73·5876	....	....	....	2	56·4245	....	....	....
1	72·9026	·8696	·0064	2·84	1	52·7616	·7366	·0308	11·98
1½	71·9679	·9359	·0303	13·36	1	50·0213	....	....	....
1	71·9354	....	....	....	1½	48·1823	·1643	·0168	6·35
2	69·1577	·1285	·0283	12·25	2	46·4392	·4238	·0315	+11·74
1	68·7609	....	....	....	2	46·4258	....	....	....

Weighted mean............. + 9·6
V_a .... −17·97
V_d .... − ·10
Curvature........................ − ·28

Radial velocity........................ − 8·7

η BOÖTIS 1553.

1908. May 25.
G. M. T. $15^h\ 58^m$

Observed by } T. H. Parker.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·9679	....	....	....	2	68·7945	·8090	·0225	9·69
1	77·3242	·3499	·0444	+20·24	2	68·7714	....	....	....
1	76·6597	·6853	·0371	16·84	2	67·8874	·9004	·0322	13·78
½	76·4693	·4923	·0189	8·58	2	64·5208	·5278	·0202	8·46
1	75·2271	....	....	....	1	63·4552	·4606	·0371	15·43
2	74·3368	·3568	0215	9·61	2	63·4326	....	....	....
2	73·6031	....	....	....	1	61·4657	·4657	·0300	12·30
2	72·3932	·4112	·0210	9·26	2	60·4492	·4482	·0214	8·73
1	71·9847	·0027	·0354	15·57	2	59·9312	·9297	·0394	15·99
2	71·3184	....	....	....	2	59·3758	·3723	·0464	18·88
2	69·8968	·9123	·0302	13·10	2	58·8903	·8853	·0275	+11·08
1	69·1583	·1728	·0186	8·03	2	56·4272	....	....	....

Weighted mean............ +12·38
V_a .... −18·59
V_d .... − ·10
Curvature........................ − ·28

Radial velocity........................ − 6·6

η BOÖTIS 1553.*

1908. May 23.
G. M. T. 15ʰ 58ᵐ

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·8899	......	......	......	2	68·7225	·8120	·0255	10·99
1	77·2379	·3419	·0364	+16·60	2	68·6957	......	......	......
2	76·5803	·6833	·0351	15·93	2	67·8170	·9050	·0368	15·73
1	76·3967	·4997	·0263	11·91	2	64·4485	·5294	·0219	9·24
2	75·1498	......	......	......	2	63·3766	·4560	·0325	13·52
3	74·2572	·3557	·0202	9·03	2	63·3594	......	......	......
2	73·5255	......	......	......	1	61·3866	·4610	·0253	10·37
2	72·3153	·4103	·0201	8·84	2	60·3764	·4489	·0221	9·02
2	71·9030	·9973	·0300	13·20	2	59·8471	·9186	·0283	11·49
2	71·8607	......	......	......	1	59·2900	·3600	·0341	13·78
2	71·2438	......	......	......	2	58·8184	·8874	·0296	+11·96
2	69·8265	·9175	·0354	15·36	2	56·3496	......	......	......
2	69·0868	·1768	·0226	9·76					

Weighted mean.......... +12·16
V_a .... −18·59
V_d .... − ·10
Curvature .... − ·28

Radial velocity.................... − 6 8

*Different standard.

η BOÖTIS 1621.

1908. June 22.
G. M. T. 14ʰ 10ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	76·8898	......	......	......	2	67·8377	·8610	·0432	18·53
2	76·5947	·6227	·0450	+20·47	2	65·5907	·6127	·0392	16·58
2	74·2843	·3110	·0440	19·71	2	64·4965	·5180	·0514	21·59
2	74·0261	·0526	·0477	21·32	2	63·3773	......	......	......
2	73·5353	......	......	......	2	60·4210	·4413	·0439	17·91
2	72·8694	·8954	·0322	14·30	2	59·8945	·9145	·0522	21·24
2	72·5840	·6100	·0353	15·64	2	58·8142	......	......	......
2	72·3438	·3693	·0418	18·47	2	58·8748	·8948	·0620	25·04
3	71·9275	·9528	·0472	20·81	2	58·5401	·5601	·0521	20·37
2	71·2520	......	......	......	2	53·9551	......	......	......
2	69·8502	·8744	·0483	21·01	2	52·1673	·1880	·0505	+19·54
3	68·7500	·7735	·0400	17·28	2	49·9791	......	......	......
2	68·7025	......	......	......					

Weighted mean.......... +19·40
V_a .... −24·75
V_d .... − ·17
Curvature .... − ·28

Radial velocity.................... − 5·8

η BOÖTIS 1621.*

1908. June 22. Observed by J. S. Plaskett.
G. M. T. $14^h\ 10^m$ Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·9515	....	....	....	3	67·8975	·8633	·0455	20·88
2	76·6545	·6195	·0458	+20·84	2	65·6520	·6150	·0415	17·55
2	74·3483	·3118	·0448	20·07	2	64·5563	·5168	·0502	21·08
2	74·0780	·0418	·0369	16·50	2	63·4410	....	....	....
2	73·5981	....	....	....	2	60·4858	·4438	·0464	18·93
2	72·9294	·8934	·0302	13·40	2	59·9466	·9046	·0423	17·22
2	72·6463	·6103	·0356	15·77	2	58·8764	....	....	....
2	72·4084	·3722	·0347	15·34	2	58·9274	·8859	·0531	21·45
2	71·9888	·9527	·0471	20·77	2	58·5948	·5533	·0453	17·71
2	71·3110	....	....	....	2	54·0116	....	....	....
2	69·9088	·8748	·0487	21·18	2	52·2260	·1960	·0585	+22·64
2	68·8137	·7802	·0467	20·17	2	50·0224	....	....	....
2	68·7675	....	....	....					

Weighted mean...........	+18·91	
V_a	....	−24·75
V_d	....	− ·17
Curvature..................		− ·28
Radial velocity............	....	− 6·3

*Check measurement.

η BOÖTIS 1663.*

1908. July 6. Observed by J. S. Plaskett.
G. M. T. $14^h\ 40^m$ Measured by W. E. Harper.

Region.	Settings I.		Difference in Revolutions.	Settings II.		Difference in Revolutions.	Mean Difference	Velocity.
	Star.	Comparison.		Star.	Comparison.			
6	·325	·359	·034	·688	·643	·045	·040	+19·04
7	·334	·363	·029	·686	·641	·045	·037	16·98
8	·341	·378	·037	·668	·632	·036	·036	15·95
9	·334	·378	·044	·676	·632	·044	·044	18·92
10	·347	·387	·040	·672	·619	·053	·046	19·14
11	·350	·403	·053	·660	·603	·057	·055	22·11
12	·372	·411	·039	·650	·603	·047	·043	16·65
13	368	·414	·046	·650	·605	·045	·046	17·30
14	·378	·425	·047	·650	·600	·050	·048	17·47
15	·397	·445	·048	·634	·579	·055	052	18·30
16	·407	·458	·051	·628	·564	·064	·057	19·49
17	·430	·467	·037	·604	·554	·050	·044	+14·56

Weighted mean............	+17·99	
*1519 Standard.......	+ ·41	
V_s	+18·40	
V_a	....	−25·77
V_d	....	− ·17
Radial velocity..........	.....	− 7·6

η BOÖTIS 1663.*

1908. July 6.
G. M. T. 14h 40m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Region.	Settings I. Star.	Settings I. Comparison.	Difference in Revolutions.	Settings II. Star.	Settings II. Comparison.	Difference in Revolutions.	Mean Difference	Velocity.
5	·021	·970	·051	·205	·246	·041	·046	+22·72
6	·009	·975	·034	·201	·250	·049	·042	20·00
7	·021	·966	·056	·206	·254	·048	·052	23·87
8	·021	·965	·056	·212	·251	·039	·047	20·82
9	·009	·967	·042	·213	·253	·040	·041	17·63
10	·995	·958	·037	·220	·266	·046	·041	17·06
11	·008	·955	·053	·229	·270	·041	·047	18·89
12	·984	·949	·035	·219	·284	·065	·050	19·41
13	·973	·944	·029	·241	·283	·042	·036	13·54
14	·989	·927	·062	·240	·284	·044	·053	19·29
15	·970	·914	·056	·250	·301	·051	·053	18·66
16	·967	·917	·050	·255	·311	·056	·053	18·13
17	·950	·905	·045	·265	·319	·054	·048	15·89
18	·931	·890	·041	·285	·324	·039	·040	12·82
19	·942	·877	·065	·291	·335	·044	·054	+16·74

Weighted mean	+18·36	
*1520 Standard	+ ·38	
V_s	+18·74	
V_a		−25·77
V_d		− ·17
Radial velocity		− 7·2

η BOÖTIS 1710.

1908. July 15.
G. M. T. 14h 41m

Observed by J. B. Cannon.
Measured by W. E. Harper.

Region.	Settings I. Star.	Settings I. Comparison.	Difference in Revolutions.	Settings II. Star.	Settings II. Comparsion.	Difference in Revolutions.	Mean Difference	Velocity.
6	·435	·396	·039	·456	·405	·051	·045	+21·42
7	·426	·386	·040	·445	·407	·038	·039	17·90
8	·426	·386	·040	·442	·391	·051	·045	19·93
9	·448	·395	·053	·439	·392	·047	·050	21·50
10	·448	·400	·048	·434	·395	·039	·043	17·89
11	·454	·391	·063	·426	·383	·043	·053	21·31
12	·436	·399	·037	·444	·400	·044	·040	15·53
13	·448	·400	·048	·444	·375	·069	·058	21·81
14	·455	·405	·050	·439	·400	·039	·045	16·38
15	·451	·396	·055	·450	·390	·060	·057	20·06
16	·461	·391	·070	·451	·395	·056	·063	21·55
17	·425	·390	·035	·452	·398	·054	·044	+14·56

Weighted mean	+19·15	
1520 Standard	+ ·38	
V_s	+19·53	
V_a		−25·71
V_d		− ·24
Radial velocity		− 6·4

η BOÖTIS 1792.

1908, Aug. 19.
G. M. T. $13^h\ 18^m$

Observed by W. E. Harper.
Measured by T. H. Parker.

Region.	Settings I. Star	Settings I. Comparison.	Difference in Revolutions.	Settings II. Star	Settings II. Comparison	Difference in Revolutions.	Mean Difference	Velocity.
5	·802	·817	·015	·718	·690	·028	·022	+10·86
6	·812	·824	·012	·697	·673	·024	·018	8·56
7	·815	·834	·019	·710	·671	·039	·029	13·31
8	·829	·846	·017	·693	·670	·023	·026	11·51
9	·828	·841	·013	·681	·660	·021	·025	10·72
10	·831	·860	.029	·685	·654	·031	·030	12·45
11	·837	·865	·028	·682	·644	·038	·033	13·23
12	·842	·868	·026	·687	·654	·033	·029	11·25
13	·853	·885	·042	·668	·640	·028	·035	13·16
14	·865	·895	·030	·660	·619	·041	·036	13·10
15	·864	·902	·039	·636	·600	·036	·037	13·02
16	·876	·909	·033	·637	·591	·046	·039	+13·29

Weighted mean .... +12·04
1519 Standard.............. + ·41
V_a .... −20·04
V_d .... − ·28

Radial velocity.............................. − 7·9

η BOÖTIS 1867.

1908. Sept. 7.*
G. M. T. $12^h\ 57^m$

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·9031	....	....	....	2	71·8856	....	....	....
1½	77·2356	·2508	·0215	+ 9.80	1	68·7611	·7763	·0428	18·49
1½	76·6039	·6189	·0452	20·61	2	68·7171	....	....	....
1	75·8642	·8777	·0405	18·35	1	67·8216	·8366	·0188	8·06
1½	72·8696	·8798	·0166	7·37	2	63·3916	....	....	....
1½	72·5992	·6116	·0369	16·35	1	60·4216	·4276	·0302	12·35
2	71·9211	.9371	·0315	13·89	½	59·3391	·3441	·0545	22·13

Weighted mean.............. +14·18
V_a .... −13·88
V_d .... − ·30
Curvature........................ − ·28

Radial velocity........................... − 0·3

η BOÖTIS 2115.

1909. Jan. 7.
G. M. T. 23^h 23^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·6775	......	......	......	2	69·3445	·3612	·0260	11·39
2	76·6430	·6575	·0344	−15·82	2	68·8810	·9002	·0381	16·65
2	76·3060	·3200	·0301	13·79	2	68·5537	......	......	......
2	74·9547	......	......	......	2	68·5247	·5245	·0502	21·80
1	74·9365	·9467	·0464	21·11	2	67·6056	·6244	·0421	18·24
1	74·0052	·0152	·0471	21·29	2	67·2315	·2501	·0393	17·02
2	73·7510	·7610	·0413	18·63	2	65·3890	·4052	·0359	15·30
2	73·3481	......	......	......	1	64·2927	·3075	·0360	15·30
2	72·6167	·6277	·0425	19·08	2	63·2724	......	......	......
2	72·3162	·3279	·0560	25·09	2	63·2091	·2230	·0486	20·41
2	71·6667	·6810	·0394	17·53	2	58·7025	·7188	·0387	−15·79
2	71·0812	......	......	......	2	58·7427	......	......	......
2	69·6012	·6173	·0409	17·91					

Weighted mean	−17·88	
V_a		+26·69
V_d		+ ·04
Curvature	− ·28	
Radial velocity		+ 8·6

η BOÖTIS 2209.

1909. Jan. 30.
G. M. T. 18^h 37^m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocit
2	81·7544	......	......	......	1	67·6626	·6721	·0448	19·3
1	80·5548	·5772	·0398	−18·75	½	66·5389	·5481	·0351	15·0
2	76·7524	......	......	......	½	64·3381	·3469	·0376	15·8
1	76·7084	·7234	·0440	20·20	2	61·3366	......	......	......
1	76·3728	·3878	·0369	16·90	½	61·1268	·1347	·0458	18·9
½	75·0031	·0159	·0481	21·79	½	59·7626	·7719	·0355	14·5
½	74·0754	·0862	·0444	20·02	1	58·4051	·4151	·0446	18·1
2	73·4156	......	......	......	½	52·0778	·0920	·0338	13·1
1	72·6808	·6896	·0450	20·07	2	49·9854	......	......	......
2	71·7318	·7410	·0412	18·29	1	48·0966	·1130	·0463	−17·[illegible]
2	68·6164	......	......	......					

Weighted mean	−19·76	
V_a		+25·02
V_d		+ ·20
Curvature	− ·28	
Radial velocity		+ 5·2

η BOÖTIS 2283.

1909. Feb 17.
G. M. T. 20^h 30^m

Observed by } J. B. CANNON.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·7061	....	....	....	1	61·0771	·1522	·0283	11·70
½	76·6704	·7317	·0357	−16·38	1	59·6981	·7740	·0324	13·27
1	74·9769	·0382	·0258	11·70	1	56·7141	·7913	·0342	13·74
½	74·0486	·1100	·0206	9·28	2	56·2824	....	....	....
1	73·0121	·0736	·0474	21·21	½	52·9986	·0808	·0450	17·53
2	73·3628	....	....	....	½	51·6967	·7801	·0303	11·78
1	72·1104	·1739	·0272	12·10	1½	49·8821	·9680	·0321	12·34
2	71·6891	·7546	·0276	12·24	1½	48·0301	·1171	·0378	14·35
1	69·6231	·6925	·0217	9·49	2	46·3428	....	....	....
2	68·5548	....	....	....	1	46·2721	·3617	·0532	19·97
1	68·5298	·6012	·0265	11·51	2	33·0633	....	....	....
½	67·6224	·6945	·0224	9·67	½	31·5776	·6899	·0444	15·19
2	63·2498	....	....	....	1	30·8284	·9422	·0517	17·61
1	63·1931	·2674	·0421	17·65	½	26·4908	·6107	·0496	−16·44

Weighted mean	−13·98	
V_a		+20·25
V_d		+ ·04
Curvature	− ·28	
Radial velocity		+ 6·0

η BOÖTIS 2396.

1909. March 26.
G. M. T. 17^h 00^m

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	77·1341	....	....	....	1	68·6049	·6109	·0168	7·29
1	76·7516	·7465	·0209	−9·59	1	67·6992	·7072	·0097	4·19
½	76·4234	·4178	·0060	2·75	2	61·3222	....	....	....
1	75·0522	·0491	·0149	6·75	1	60·3016	·3269	·0113	4·64
1	74·1209	·1191	·0115	5·19	1	59·7754	·8027	·0037	1·51
2	73·4249	....	....	....	1	58·4149	·4462	·0135	5·48
1	72·7076	·7079	·0267	11·91	2	49·9442	....	....	....
½	72·4306	·4318	·0157	7·00	1	49·9466	0041	·0068	2·61
2	71·7664	·7688	·0134	5·95	2	30·9059	....	....	....
2	71·1534	....	....	....	1	30·8756	·9795	·0144	−4·91
1	69·7034	·7074	·0068	2·97					

Weighted mean	− 5·59	
V_a		+ 8·52
V_d		+ ·14
Curvature	− ·28	
Radial velocity		+ 2.8

OBSERVING RECORD AND DETAILED MEASURES OF α CORONÆ BOREALIS.

RECORD OF SPECTROGRAMS.

P.—Plaskett.
P[1].—Parker.
H.—Harper.
C.—Cannon.
T.—Tribble.

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure G. M. T.	Duration.	Hour Angle at end.	Temperature. Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width.	Seeing.	Observer.
				1907.	h. m.	m.	h. m.							
α Coronæ Borealis :	784	IL	Seed 27.	May 24	17 43	10	1 20W.	9·0	9.4	16·4	16·4	·001	Fair.. ..	P
" ..	790	"	" ..	" 29	15 14	12	50W.	8·9	9·0	14·5	14·5	·001	" ...	P
" ..	800	"	" ..	" 31	17 18	8	1 20W.	13·0	12·8	18·8	18·8	·001	Good...	P
" ..	808	"	" ..	June 8	16 28	10	1 05W.	15·4	15·2	17·2	17·2	·001	....	P
" ..	813	"	" ..	" 10	15 23	10	0 00	14·8	14·6	18·1	18·1	·001	....	P
" ..	830	"	" ..	" 11	17 40	10	2 15W.	14·0	14·0	18·9	18·9	·001	Fair....	H
" ..	837a	"	" ..	" 12	17 36	12	2 30W.	17·0	16·3	19·0	19·0	·001	" ...	P
" ..	837b	"	" ..	" 12	17 52	12	2 42W.	16·0	15·6	19·0	19·0	·001	" ...	P
" ..	845	"	" ..	" 13	16 32	15	1 30W.	19·8	19·4	25·8	25·8	·0012	" ...	H
" ..	850a	"	" ..	" 14	16 39	12	1 40W.	21·6	21·4	23·3	23·3	·0012	" ...	P
" ..	850b	"	" .	" 14	16 52	5	1 50W.	21·4	21·1	23·3	23·3	·0012	Good...	P
" ..	869a	"	" ..	" 21	15 10	15	50W.	24·8	24·8	28·9	28·9	·001	Hazy...	P
" ..	869b	"	" ..	" 21	15 42	15	1 20W.	24·8	24·6	28·9	29·0	·001	" ...	P
" ..	892a	"	" ..	" 27	15 25	10	1 17W.	21·2	20·9	24·5	24·5	·0012	Fair....	H
" ..	892b	"	" ..	" 27	15 37	5	1 25W.	20·9	20·9	24·5	24·5	·0012	Cloudy.	T
" ..	903a	"	" ..	" 28	14 36	13	33W.	23·8	23·6	26·4	26·3	·0012	Fair....	P
" ..	903b	"	" ..	" 28	14 57	25	1 00W.	23·5	22·8	26·3	26·2	·0012	" ...	P
" ..	912a	"	" ..	July 4	15 38	10	2 00W.	21·0	20·5	29·0	28·8	·0012	Good. .	H
" ..	912b	"	" ..	" 4	15 47	5	2 17W.	21·0	20·0	28 8	28·6	·0012	" ..	H
" ..	917	"	" ..	" 5	15 20	10	1 45W.	21·0	20 8	26·4	26·4	·0011	....	P
" ..	919	"	" ..	" 8	15 36	22	2 05W.	21·2	21·2	22·4	22·4	·C012	Fair....	P
" ..	927	"	" ..	" 9	14 32	15	1 14W.	23·1	23·1	24·5	24·5	·0012	Good...	H
" ..	939a	"	" ..	" 12	16 25	10	4 15W.	22·6	22·4	26·0	26·0	·0012	" ...	P
" ..	939b	"	" ..	" 12	16 33	$2\frac{1}{2}$	4 20W.	22·6	22·4	26·0	26·0	·0012	" ...	P
" ..	941a	"	" ..	" 13	15 25	10	3 15W.	18·2	18·0	25·2	25·0	·0012	....	T
" ..	941b	"	" ..	" 13	15 32	3	3 20W.	18·0	17·8	25·0	25·0	·0012	....	T
" ..	944a	"	" ..	" 16	14 37	13	1 42W.	25·5	25·5	26·8	26·8	·0012	Unst'dy	T
" ..	944b	"	" ..	" 16	14 49	6	1 53W.	25·5	25·5	26·8	26·8	·0012	"	T
" ..	951a	"	" ..	" 18	14 50	60	2 32W.	26·0	25·0	28·5	28·5	·0012	Very hazy..	T
" ..	951b	"	" ..	" 18	15 32	5	2 45W.	22·5	22·5	28·5	28·5	·0012	"	H
" ..	956a	"	" ..	" 20	16 07	14	3 30W.	19·2	18·6	21·6	21·6	·0012	Good...	P
" ..	956b	"	" ..	" 20	16 17	2	3 32W.	19·2	18·6	21·6	21·6	·0012	" ...	P
" ..	963a	"	" ..	" 23	14 32	6	2 05W.	23·2	23·2	26·4	26·4	·0012	" ..	T
" ..	963b	"	" ..	" 23	14 41	3	2 15W.	22·6	22·6	26·4	26·4	·0012	....	T
" ..	973a	"	" ..	Aug. 1	14 06	12	2 15W.	21·3	21·0	25·2	25·2	·0008	......	H
" ..	973b	"	" ..	" 1	14 18	8	2 26W.	21·0	19·5	25 2	25·2	·0008	......	H
" ..	978	"	" ..	" 3	13 02	8	1 15W.	21·6	20·8	24·1	24·1	·0012	....	P
" ..	986	"	" ..	" 6	16 38	23	5 15W.	19·5	19·4	23·3	23·3	·0012	Poor....	H
" ..	1006	"	" ..	" 12	16 36	12	5 31W.	23·0	22·5	29·0	29·0	·0014	Unst'dy	H
" ..	1014	"	" ..	" 15	15 09	7	4 20W.	22·3	19·5	26·3	26 3	·0014	Very poor..	H
" ..	1017	"	" ..	" 22	15 11	11	4 47W.	18·7	18·5	24·1	24·2	·0014	Fair....	H
" ..	1022	"	" ..	" 23	14 46	62	4 46W.	22·5	21·4	27·0	27·0	·0014	Light clouds.	T
" ..	1026	"	" ..	" 27	12 06	13	2 57W.	18·5	18·5	20·6	20·6	·0014	Fair....	H
" ..	1032	"	" ..	Sept. 6	13 43	17	4 15W.	19·0	18·5	21·0	21·0	·0012	Good...	T
" ..	1037	"	" ..	" 12	14 39	18	5 37W.	17·0	16·8	20·9	20·9	·0012	" ...	T
" ..	1047	"	" ..	" 18	12 50	30	4 17W.	15·0	15·0	17·1	17·1	·0012	Cloudy.	T
" ..	1048	"	" ..	" 18	13 16	16	4 36W.	15·0	14·2	17·1	17·1	·0012	Fair....	T
" ..	1060	"	" ..	" 20	13 35	20	5 05W.	22·0	22·0	22·9	22·9	·0012	Poor....	H
" ..	1061	"	" ..	" 20	13 58	24	5 30W.	22·0	22·3	22·9	22·9	·0012	" ...	H
" ..	1083	"	" ..	Oct. 1	13 44	16	5 55W.	10·5	10·4	14·2	14·2	·0014	....	H
" ..	1084	"	" ..	" 1	14 06	27	6 23W.	10·4	10·2	14·2	14·1	·0014	Hazy...	H

RECORD OF SPECTROGRAMS.—(*Concluded*).

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure. G. M. T.	Duration.	Hour Angle at end.	Temperature. Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width.	Seeing.	Observer.
				1908.	h. m.	m.	h. m.							
α Coronæ Borealis:	1393	IL	Seed 27.	Mar. 9	22 08	24	55W.	−15·0	−15·0	1·0	1·0	.....	Hazy...	H
" ..	1402	"	" ..	" 16	21 02	10	9W.	−12·5	−13·0	2·3	2·3	.....	Good...	H
" ..	1493	"	" ..	Apr. 15	19 18	8	28W.	− 3·0	− 2·3	7·8	7·7	.....	" ...	P
" ..	1565	"	Seed Process	June 1	18 00	30	2 50W.	15·7	14·6	21·4	21·3	.....	" ...	P-P1
" ..	1566	"	Seed 27.	" 1	18 42	15	3 13W.	14·5	14·0	21·3	21·2	.....	Fair....	P1
" .	1571	"	" ..	" 3	16 32	15	57W.	14·9	15·0	18·4	18·4	.....	" ...	P
" ..	1572	"	" ..	" 3	16 52	15	1 20W.	15·0	14·8	18·4	18·4	.....	" ...	P
" .	1581	"	" ..	" 5	17 31	18	2 04W.	17·5	17·0	24·6	24·6	·0016	Good...	H
" ..	1601	"	" ..	" 12	16 56	12	1 54W.	19·5	19·0	25·0	25·0	·0017	" ...	H
" ..	1608	"	" ..	" 17	13 53	14	50E.	19·0	18·5	23·4	23·3	·0016	" ...	H
" ..	1623	"	" ..	" 22	16 27	14	2 10W.	18·3	18·0	23·7	23·8	·0015	Fair....	P
" ..	1624	"	" ..	" 22	16 43	13	2 25W.	18·0	18·0	23·8	23·8	·0015	Good...	P
" ..	1628	"	" ..	" 24	15 26	18	1 15W.	21·5	21·5	27·5	27·5	·0015	" ...	P
" ..	1629	"	" .	" 24	15 49	15	1 35W.	21·5	21·5	27·5	27·5	·0015	" ...	P
" ..	1638	"	" ..	" 26	15 51	15	1 48W.	21·0	20·5	30·0	30·0	·0016	" ...	H
" ..	1639	"	" ..	" 26	16 04	8	1 57W.	20·5	21·0	30·0	30·0	·0016	" ...	H
" ..	1646	"	" ..	" 27	16 20	10	2 20W.	20·8	20·5	23·8	23·8	·0014	" ...	P
" ..	1647	"	" ..	" 27	16 30	10	2 30W.	20·5	.....	.....	.....	.....	Fair....	P
" ..	1652	"	" ..	July 1	15 15	30	1 30W.	23·6	23·6	25·8	25·8	·0015	Cloudy..	P
" ..	1656	"	" ..	" 3	15 17	13	1 38W.	23·0	21·9	25·5	25·5	·001	Good...	H
" ..	1665	"	" ..	" 6	16 50	10	3 20W.	24·0	23·8	26·4	26·4	·0015	" ...	P
" ..	1674	"	" ..	" 8	15 11	10	1 50W.	19·0	19·3	21·8	21·8	·0015	Fair....	C
" .	1683	"	" ..	" 10	13 34	20	26W.	25·0	24·5	27·5	27·5	·0012	Good...	H
" ..	1684	"	" ..	" 10	13 51	13	40W.	24·5	24·5	27·5	27·5	·0012	" ...	H
" ..	1692	"	" ..	" 11	16 20	10	3 12W.	27·7	27·5	30·1	30·1	·0015	Fair....	P
" .	1697	"	" ..	" 13	15 26	13	2 25W.	20·0	19·9	23·1	23·1	·0015	" ...	P
" ..	1698	"	" ..	" 13	15 42	16	2 50W.	19·9	19·6	23·1	23·1	·0015	" ...	P
" ..	1711	"	" ..	" 15	16 24	12	3 30W.	17·5	17·0	21·6	21·6	·0015	Good..	C
" ..	1721	"	" ..	" 24	13 05	15	48W.	24·0	24·0	26·4	26·4	·0012	" ...	H
" ..	1722	"	" ..	" 24	13 21	14	1 03W.	24·0	24·0	26·4	26·4	·0012	" ...	H
" ..	1739	"	" ..	" 29	15 34	12	3 37W.	26·6	26·3	30·2	30·2	·0015	Fair....	P
" .	1748	"	" ..	" 31	13 38	17	2 00W.	23·3	23·1	26·0	26·0	·0015	" ...	P1
" ..	1749	"	" ..	" 31	14 00	20	2 20W.	23·0	22·6	26·0	26·0	·0015	" ...	P1
" ..	1764	"	" ..	Aug. 5	15 37	15	4 10W.	22·0	21·6	26·9	26·9	·0015	" ...	P
" ..	1773	"	" ..	" 7	14 25	20	3 05W.	21·5	20·6	23·6	23·6	·0015	Hazy...	P1
" ..	1775	"	" ..	" 7	16 25	10	5 05W.	19·1	19·0	23·6	23·6	·0015	Good...	P1
" ..	1797	"	" ..	" 20	12 51	16	2 21W.	19·2	19·0	23·1	23·1	·0015	Fair.....	H
" ..	1798	"	" ..	" 20	13 05	10	2 32W.	19·0	18·8	23·1	23·0	·0015	Good...	H
" ..	1805	"	" ..	" 21	12 54	11	2 22W.	21·1	20·6	25·8	25·8	·0015	" ...	C
" ..	1809	"	" ..	" 21	15 01	12	4 30W.	18·8	18·4	25·0	25·4	·0015	" ...	C
" ..	1816	"	" ..	" 24	13 17	15	3 03W.	18·5	18·2	23·4	23·4	·0015	" ...	H
" ..	1817	"	" ..	" 24	13 32	14	3 17W.	18·2	17·5	23·4	23·3	·0015	" ...	H
" ..	1827	"	" ..	" 25	13 00	14	2 49W.	20·6	19·3	26·0	26·0	·0015	Hazy...	C
" ..	1836	"	" ..	" 27	14 34	12	4 30W.	18·3	18·0	23·2	23·2	·0015	Good...	C
" ..	1842	"	" ..	" 28	13 14	12	3 16W.	18·5	18·2	23·3	23·3	·0015	" ...	C
" ..	1852	"	" ..	" 31	13 17	15	3 30W.	24·0	24·0	28·0	28·0	·0015	" ..	H
" ..	1861	"	" ..	Sept. 3	12 50	13	3 15W.	18·6	18·8	21·2	21·1	·0015	" ...	P
" ..	1865	"	" ..	" 4	13 27	26	4 05W.	20·5	20·3	23·4	23·4	·0015	Poor....	P1
" ..	1882	"	" ..	" 14	12 51	13	4 00W.	18·6	18·4	21·7	21·7	·0015	Fair....	P
" ..	1894	"	" ..	" 19	12 02	13	3 30W.	17·5	17·3	21·2	21·2	·0015	" ...	P
" ..	1895	"	" ..	" 19	12 17	15	3 45W.	17·3	17·2	21·2	21·2	·0015	" ...	P
" ..	1896	"	" ..	" 19	12 32	15	4 00W.	17·2	16·8	21·1	21·1	·0015	" ...	P
" ..	1897	"	" .	" 19	12 50	16	4 20W.	16·8	16·5	21·1	21·0	·0015	" ...	P
" ..	1949	"	" ..	Nov. 1	10 41	17	5 00W.	2·0	0·6	3·8	3·8	·0015	Good...	C
" ..	1991	"	" ..	Dec. 2	10 10	10	6 19W.	− 7·5	− 8·2	−2·0	−2·0	·0015	Windy	C
" ..	1992	"	" ..	" 2	10 21	13	6 30W.	− 8·2	− 8·2	−2·0	−2·0	·0015	" .	C

α CORONÆ BOREALIS, 784.

1907. May 24.
G. M. T. 17h 43m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	72·9951	4891·192	......	......	......	......	1½	27·6301	4105·162	......	......	......	......
2	72·7321	4861·180	·187	·527	·340	−21·00	1	27·3080	4101·318	·440	·890	·450	−32·90
½	72·3165	4851·453	......	......	......	......	1½	27·1825	4099·824	......	......	......	......
2	47·6461	4379·418	......	......	......	......	½	15·4180	3969·627	·807	·177	·670	−50·77
2	45·0940	4340·085	·054	·634	·580	−40·02	2	15·3605	3969·034	......	......	......	......
2	44·1555	4325·981	......	......	......	......	3	28·1875	4111·853	......	......	......	......

Weighted mean	−32·78
V_a	− 7·63
V_d	− ·07
Curvature	− ·28
Radial velocity	−39·8

α CORONÆ BOREALIS, 790.

1907. May 29.
G. M. T. 15h 14m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	73·2093	4870·229	......	......	......	......	2	27·7347	4105·312	......	......	......	......
2	72·8135	4800·908	2·107	1·527	·580	+35·78	1½	27·5259	4102·815	·700	1 890	·810	+59·21
2	63·6051	4661·138	......	......	......	......	3	27·2873	4099·970	......	......	......	......
3	48·7335	4395·316	......	......	......	......	½	15·64—	3970·820	·797	·177	·620	+47·00
1	45·2535	4341·252	......	......	......	......	3	15·4860	3969·232	......	......	......	......
2	45·2502	4341·201	·114	0·634	·480	+33·12							

Weighted mean		+41·68
V_a	− 9·22	
V_d		+ ·10
Curvature	− ·28	
Radial velocity		+32·3

α CORONÆ BOREALIS, 794.

1907. May 29. G. M. T. $18^h\ 05^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacemen in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length	Displacement in revolutions.	Velocity.
2	72·8775	4862·407	·407	1·527	·880	+59·30	1	27·5506	4102·369	·360	1·890	·470	+34·36
1½	63·6559	4661·600	....	....	....	....	½	12·111–	3934·713	·795	3·825	.970	+74·01
	45·3234	4341·403	·388	0·634	·754	+52·02	3	11·6613	3930·276	....	....	....	....
	45·3085	4341·177	....	....	....	....							
	27·7905	4105·235	....	....	....	....							

Weighted mean		+53·45
V_a	– 9·22	
V_d	– ·14	
Curvature	– ·28	
Radial velocity		+43·8

α CORONÆ BOREALIS, 800.

1907. May 31. G. M. T. $17^h\ 18^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions	Velocity.
	73·2965	4871·490	....	....	....	....	1½	45·3314	4341·634	1·000	0·634	·366	+25·25
	72·8966	4862·058	2·021	1·527	·494	+30·48	2	45·3203	4341·463	....	....	....	....
1½	63·6950	4662·143	....	....	....	....							

Weighted mean		+28·24
V_a	– 9·87	
V_d	– ·09	
Curvature	– ·28	
Radial velocity		+18·00

α CORONÆ BOREALIS, 800*.

1907. May 31. Observed by J. S. PLASKETT.
G. M. T. $17^h\ 18^m$ Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	73·1662	4870·711	......	......	......	....	½	53·9228	4482·746	·156	·400	·756	+[50·57]
2	72·7643	4861·253	·993	·527	·366	+22·58	1½	45·1975	4341·903	......	......	......	....
1	53·9370	4482·990	......	......	......	....	2	45·1921	4341·822	·084	·634	·450	+31·05

Weighted mean....................		+26·82
V_a	− 9·87	
V_d	− ·09	
Curvature........	− ·28	
Radial velocity...		+16·6

*Check measurement.

α CORONÆ BOREALIS, 808.

1907. June 8. Observed by J. S. PLASKETT.
G. M. T. $16^h\ 28^m$ Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	73·6301	4880·622	......	......	......	....	1½	53·2825	4459·560	......	......	......	....
1½	73·2099	4870·635	......	......	......	....	1½	45·2977	4341·340	......	......	......	....
2	72·7779	4860·446	·117	·527	·410	−25·30	1½	45·2356	4340·399	·224	·634	·410	−28·29
1½	54·7247	4494·835	......	......	......	....	½	27·4985	4101·465	·740	·890	·150	−10·97
1	53·9597	4481·558	·400	·400	·000	[0·00]	2	27·3464	4099·648	......	...	......	....

Weighted mean....................	−24·63
V_a	−12·26
V_d	− ·07
Curvature	− ·28
Radial velocity	−37·2

a CORONÆ BOREALIS, 813.

1907. June 10.
G. M. T. 15^h 23^m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
1	72·9500	4864·729	......	.....	.....	....	1½	45·2570	4340·581	·584	·634	·050	− 3·45
2	72·7916	4860·995	·047	·527	·480	−29·62	1	27·4836	4101·565	·565	·890	·325	−23·76
1	54·0328	4482·605	......	.....	......	....	½	11·9745	3933·225	·505	·825	·320	−23·52
½	53·9933	4481·933	·720	·400	·320	+[21·40]	3	11·6547	3930·072	......	......	......	....

Weighted mean....................	−19·99
V_a....................	−12·82
V_d....................	·00
Curvature................	− ·28
Radial velocity................	−33·1

a CORONÆ BOREALIS, 813*.

1907. June 10.
G. M. T. 15^h 23^m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0019	....	....	.. ..	1	27·4611	·3746	·0380	−33·00
1	72·8452	·8543	·0105	−15·23	2	27·3334	....	....	....
1	72·4360	....	... .	....	½	11·9831	·8494	·0020	− 1·50
2	45·2862	....	....	....	½	11·6415	....	....	....
1½	45·2550	·2404	·0017	+ 1·77					

Weighted mean....................	−11·33
V_a....................	−12·82
V_d....................	·00
Curvature................	− ·28
Radial velocity................	− 23·4

Check measurement.

α CORONÆ BOREALIS, 830.

1907. June 11.
G. M. T. $17^h\ 40^m$

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0400	......	......	......	1	27·5388	·4018	·0108	− 9·37
½	72·9005	·8714	·0066	+ 9·57	2	27·3838	......	......	......
2	72·4707	......	......	......	½	15·6378	·4462	·0271	−20·97
2	45·3505	......	......	......	2	15·5903	......	......	......
1½	45·2971	·2202	·0177	−19·31					

Weighted mean	−12·59
V_a	−13·12
V_d	− ·14
Curvature	− ·28
Radial velocity	− 26·1

α CORONÆ BOREALIS, 837 (a).

1907. June 12.
G. M. T. $17^h\ 36^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.
2	73·2575	4871·377	......	......	......	......	1½	53·2836	4469·109	·260	1·400	·140	− 9·37
2	72·9590	4864·316	......	......	......	......	2	45·2743	4341·034	......	......	......	......
1	72·7939	4860·427	·027	·527	·500	−30·85	2	45·2468	4340·618	·744	·634	·110	+ 7·59
1½	54·7243	4494·565	......	......	......	......	1	27·4500	4101·723	·700	·890	·190	−13·40
1	54·0416	4482·729	·880	1·400	·1480	+[99·01]	2	27·2997	4099·937	......	......	......	......
1½	53·9476	4484·109	......	......	......	......							

Weighted mean	− 7·84
V_a	−13·39
V_d	− ·15
Curvature	− ·28
Radial velocity	− 21·7

α CORONÆ BOREALIS, 837 (b).

1907. June 12.
G. M. T. 17ʰ 48ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.
2	73·3641	4871·496	.....	.....	......	....	1½	45·3637	4340·923	·834	·634	·200	+13·80
1½	73·0748	4864·652	......	......	......	....	1	27·5769	4102·126	·780	·890	·110	− 8·74
1	72·9262	4861·152	·417	·527	·080	− 4·90	2	27·4205	4100·265	......	. . .	......	....
2	45·3955	4341 251	... ..	......	......	....							

Weighted mean	+ 2·22
V_a	−13·39
V_d	− ·15
Curvature	− ·28
Radial velocity	− 11·6

α CORONÆ BOREALIS, 845.

1907. June 13.
G. M. T. 16ʰ 32ᵐ

Observed by }
Measured by } W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	73·5911	4875 434	......	......	......	....	½	30·3756	4135·609	·374	......	......	......
2	73·1412	4864·776	......	......	......	....	3	30·3142	4134·852	......	......	......	....
1	73·0219	4861·964	·817	·527	·290	+17·89	1	27·6096	4102·126	1·921	·890	·031	+ 2·27
2	45·4418	4341·360	......	......	......	....	2	27·4418	4100·132	......	......	......	....
1½	45·4224	4341·068	0·868	·634	·23.4	+16·14							

Weighted mean	+12·68
V_a	−13·65
V_d	− ·10
Curvature	− ·28
Radial velocity	− 1·4

α CORONÆ BOREALIS, 850 (*a*).

1907. June 14.
G. M. T. 16^h 39^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	73·4113	4875·633	.....	......	......	....	1½	53·9875	4482·586	1·046	·400	·646	+[43·22]
2	72·9635	4865·037	......	...	......	....	1½	53·2781	4470·405	......	.....	......	....
1	72·8279	4861·845	·747	·527	·220	+13·57	2	45·2668	4341·590	......	......	......	....
1½	54·3973	4489·656	......	.....	......	....	2	45·2482	4341·307	0·879	·634	·245	+16·90

Weighted mean		+15·79
V_a	−13 92	
V_d	− ·12	
Curvature	− ·28	
Radial velocity		+ 1·5

α CORONÆ BOREALIS, 850 (*b*).

1907. June 14.
G. M. T. 16^h 52^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
1½	73 4199	4875·835	......	......	......	....	2	45·2684	4341·613	·188	·634	·554	+38·23
1½	72 9691	4865·169	......	...	......	....	1	27·4757	4102·322	2·290	1·890	·400	+29·24
1	72·8446	4862·238	1·997	·527	·470	+29·00	2	27·2770	4099·954	.. ..	.....	......	....
2	45·2666	4341·587	......	......	......	....							

Weighted mean		+33·68
V_a	−13·92	
V_d	− ·12	
Curvature	− ·28	
Radial velocity		+19·4

α CORONÆ BOREALIS. 861 (a).

1907. June 20.
G. M. T. $16^h\ 05^m$

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.
1	73·2760	4871·450	......	......	......	....	1½	45·2526	4341·493	.....	......	......	....
1½	72·9905	4864·720	......	.....	......	....	1½	45·2364	4341·249	0·918	0·634	·284	+19·60
1	72·8861	4862·267	2·467	1·527	·940	+58·00	1	27·4436	4102·363	2·320	1·890	·430	+31·43
¼	54·0070	4482·788	2·495	1·400	1·095	+[73.25]	1½	27·2416	4099·960	.....	...	......	....
½	53·2695	4470·164	....	......	......	....							

Weighted mean..................		+33.95
V_a	−15·42	
V_d	− ·11	
Curvature.........	− ·28	
Radial velocity..............		+ 17·1

α CORONÆ BOREALIS, 869 (a).

1907. June 21.
G. M. T. $15^h\ 10^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·4558	....	....	....	1	53·1220	....	....	....
1½	72 9987	....	....	....	2	45·2828	....	....	....
1	72·8723	·8833	·0185	+26·84	2	45·2626	·2574	·0187	+19·52
1	72 4343	....	....	....	1	27·4687	·4329	·0203	+17·62
1½	54·7447	....	....	....	2	27·2824	....	....	....
½	54·0017	·9962	·0264	+[30·39]					

Weighted mean..................		+20·88
V_a	−15·65	
V_d	− ·05	
Curvature.........	− ·28	
Radial velocity..............		+ 4·9

α CORONÆ BOREALIS. 869 (*b*).

1907. June 21.
G. M. T. $15^h\ 42^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·4265	......	......	......	1½	53·0887	......	......	......
1½	72·9753	......	......	......	2	45·2563	......	......	......
1	72·8572	·8940	·0292	+42·37	2	45·2497	·2670	·0283	+29·53
1	72·4075	......	......	......	½	27·4248	·4145	·0019	+ 1·65
2	54·7245	......	......	......	2	27·2569	......	......	......
1	54·0007	·0197	·0499	+[57·42]					

Weighted mean		+29·22
V_a	−15·66	
V_d	− ·07	
Curvature	− ·28	
Radial velocity		+13·2

α CORONÆ BOREALIS, 880.

1907. June 25.
G. M. T. $15^h\ 43^m$

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	49·3450	......	......	......	½	27·4294	·4144	·0018	+ 1·50
2	45·1892	·2092	·0295	−30·80	1	27·2616	......	......	......
2	44·2398	......	......	......					

Weighted mean	−24·34
V_a	−16·56
V_d	− ·10
Curvature	− ·28
Radial velocity	− 41·3

α CORONÆ BOREALIS, 888.

1907. June 26.
G. M. T. 15^h 01^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	48·7894	....	....	....	½	27·5130	·5033	·0168	+13·57
2	45·2958	·2794	·0307	+32·14	1	27·3316	....	....	....
2	45·2880	....	....	....					

Weighted mean................ .... . +28·42
V_a .... −18·76
V_d .... − ·05
Curvature....... − ·28

Radial velocity..... .... +11·3

α CORONÆ BOREALIS, 892 (a).

1907. June 27.
G. M. T. 15^h 25^m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·9825	....	....	....	2	45·2750	....	....	....
1	72·8545	·8822	·0174	+25·20	½	45·2277	·2363	·0124	−12·98
2	72·4160	....	....	....	2	57·8430	·8237	·0190	+(22·91)*
½	54·0205	....	....	....	1½	57·8172	....	....	....
¼	53·9655	·9603	·0037	+[4·27]					

Weighted mean... .... +12·47
V_a .... −16·98
V_d .... − ·09
Curvature.............. − ·28

Radial velocity.. .... − 4·9

*Not used.

α CORONÆ BOREALIS, 892 (*b*).

1907. June 27.
G. M. T. $15^h\ 25^m$

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0205	....	....	....	2	54·7740	....	....	....
½	72·8582	·8479	·0169	−24·52	1	54·0162	·9814	·0116	+[13·35]
2	72·4540	....	....	....	2	53·1495	....	....	....
2	57·8550	....	....	....	2	45·3208	....	....	....
½	57·8570	·8288	·0020	+(2·41)*	1	45·2668	·2196	·0191	−19·94

Weighted mean....................	−21·47
V_a....................	−16·98
V_d....................	− ·09
Curvature....................	− ·28
Radial velocity....................	−38·8

*Not used.

α CORONÆ BOREALIS, 912 (*a*).

1907. July 4.
G. M. T. $15^h\ 38^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·4621	....	....	....	3	54·0285	·0243	·0545	+[62·73]
1	73·0125	....	....	....	2	53·1130	....	....	....
½	72·8823	·8823	·0175	+25·39	2	45·2818	....	....	....
½	72·4506	....	....	....	1½	45·2930	·2848	·0461	+48·13
1½	54·7496	....	....	....					

Weighted mean....................		+43·58
V_a....................	−18·30	
V_d....................	− ·14	
Curvature....................	− ·28	
Radial velocity....................		+24·9

α CORONÆ BOREALIS, 917 (a).

1907. July 5.
G. M. T. 15^h 20^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9847	....	....	....	2	53·1159	....	....	....
1	72·8795	·9040	·0392	+56·38	2	45·2826	....	....	....
1½	72·4219	....	....	....	2	45·2955	·2865	·0478	+49·90
2	54 7410	....	....	....	½	27·4935	·4460	·0334	+28·99
¼	54·022-	·0210	·0512	+[58·93]	2	27·2942	....	....	....

Weighted mean..................		+48·77
V_a..............	−18·45	
V_d..............	− ·10	
Curvature......	− ·28	
Radial velocity..................		+29·9

α CORONÆ BOREALIS, 919.

1907. July 8.
G. M. T. 15^h 36^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings,	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9772	....	....	....	1½	45·2712	·2697	·0210	+21·98
1	72·8492	·8372	·0185	+26·88	1	27·5298	·5265	·0300	+34·16
2	72·4058	....	....	....	1	30·9330	....	....	....
2	45·2852	....	....	....	2	27·3256	....	....	....

Weighted mean..................		+26·86
V_a..............	− 18·95	
V_d..............	− ·14	
Curvature......	− ·28	
Radial velocity..................		+ 7·5

α CORONÆ BOREALIS, 927.

1907. July 9.
G. M. T. 14ʰ 32ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9662	....	....	....	2	45·2862	....	....	....
1	72·8618	·8562	·0375	+54·48	1½	45·2380	·2354	0133	−13·92
2	72·4106	....	....	....	½	27·4734	·4889	·0076	+ 1·40
2	54·7306	....	....	....	2	27·3064	....	....	....
1	53·9888	·9833	·0267	+[30.81]	½	57·8628	·8428	·0428	+(51·62)*
2	53·1078	....	....	....	2	57·8178	....	....	....

Weighted mean............	+11·43	
V_a		−19·09
V_d		− ·08
Curvature..........................		− ·28
Radial velocity..........................		− 8·0

*Not used.

α CORONÆ BOREALIS, 927.**

1907. July 9.
G. M. T. 14ʰ 32ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	72·9680	....	....	....	1	53·9622	·9697	·0131	+[15·12]
1	72·8569	·8503	·0316	+45·91	1½	53·0917	....	....	....
1½	72·4102	....	....	....	2	45·2603	....	....	....
½	57·8736	·8675	·0675	+(81·27)*	1½	45·2267	·2500	·0013	+ 1·36
1½	57·8040	....	....	....	½	27·4465	·4910	·0055	+ 3·20
2	54·7205	....	....	....	3	27·2774	....	....	....

Weighted mean............	+16·52	
V_a		−19·09
V_d		− ·08
Curvature..........................		− ·28
Radial velocity..........................		− 2·9

**Check measurement.
*Not used.

α CORONÆ BOREALIS, 936.

1907, July 10. Observed by J. S. PLASKETT.
G. M. T. $14^h\ 06^m$ Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	73·4385	...	...	...	2	45·3045	·2916	} mean .0317	+33·18
2	72·9873	...	...	...	2	45·2722	·2693		
1	72·8610	·8370	·0183	+26·58	1	27·4904	·5206	·0241	+28·99
2	45·2865	...	...	...	2	27·2917	...	...	...

Weighted mean .... +30·48
V_a .... −19·23
V_d .... − ·05
Curvature .... − ·28

Radial velocity .... + 10·9

α CORONÆ BOREALIS, 936*

1907. July 10. Observed by J. S. PLASKETT.
G. M. T. $14^h\ 06^m$ Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings	Displacement in Revolutions.	Velocity.
2	73·0197	...	...	...	½	27·5361	·4419	·0293	+25·43
½	72·8963	·8854	·0206	+29·89	2	27·3413	...	...	...
2	72·4588	...	...	...	½	12·0294	·9169	·0655	+49·06
2	45·3296	...	...	...	2	11·6198	...	...	...
1	45·3064	·2504	·0117	+12·21					

Weighted mean .... +25·76
V_a .... −19·23
V_d .... − ·05
Curvature .... − ·28

Radial velocity .... + 6·2

*Check measurement.

α CORONÆ BOREALIS, 939 (*a*).

1907. July 12. Observed by J. S. PLASKETT.
G. M. T. $16^h\ 25^m$ Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9412	...	...	...	1½	45·2344	·2304	·0183	−19·16
1	72·7980	·8200	·0013	+ 1·89	1	27·4394	·4837	·0035	− 3·16
2	72·3774	...	...	...	2	27·2776	...	...	...
2	45·2876	...	...	...					

Weighted mean .... − 8·58
V_a .... −19·52
V_d .... − ·23
Curvature .... − ·28

Radial velocity .... − 28·6

α CORONÆ BOREALIS, 941 (*a*).

1907. July 13.
G. M. T. $15^h 25^m$

Observed by J. N. Tribble.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9571				1	53·9164	·9216	·0350	−[36·57]
1	72·7891	·7967	·0220	−31·94	2	45·2737			
2	72·3883				2	45·2395	·2494	·0010	+ 1·05
1	54·0101								

Weighted mean	− 9·95
V_a	−19·64
V_d	− ·20
Curvature	− ·28
Radial velocity	− 30.1

α CORONÆ BOREALIS, 944 (*a*).

1907. July 16.
G. M. T. $14^h 37^m$

Observed by J. N. Tribble.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9844				2	45·2506	·2292	·0095	− 9·94
1	72·8686	·8938	·0290	+42·08	¼	27·4712	·4048	·0078	− 6·57
1½	72·4200				2	27·3130			
2	45·2950								

Weighted mean	− ·20
V_a	−19·98
V_d	− ·11
Curvature	− ·28
Radial velocity	−20·6

α CORONÆ BOREALIS, 944 (*a*)*.

1907. July 16.
G. M. T. $14^h 37^m$

Observed by J. N. Tribble.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0086				2	53·1311			
½	72·8748	·8752	·0104	+15·09	2	45·3033			
2	72·4466				1	45·2588	·2290	·0097	−10·1[illegible]
2	54·7631				½	27·5206	·4520	·0394	+34·2[illegible]
¼	54·0116	·9915	·0217	+[21·98]	2	27·3153			

Weighted mean	+ 7·26
V_a	−19·98
V_d	− ·11
Curvature	− ·28
Radial velocity	−13·1

*Check measurement.

α CORONÆ BOREALIS, 951 (*a*).

1907. July 18.
G. M. T. 14^h 50^m

Observed by J. N. Tribble.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0275				¼	53·9282	·0274	·0576	+[60·30]
⅛	72·8907	·8738	·0090	+13·06	2	53·0075			
2	72·4593				2	45·1272			
2	54·6480				½	45·0922	·2386	·0001	−18·0

Weighted mean .... + 2·53
V_a .... −20·16
V_d .... − ·14
Curvature .... − ·28

Radial velocity .... − 18·0

α CORONÆ BOREALIS, 951 (*b*).

1907. July 18.
G. M. T. 15^h

Observed by J. N. Tribble.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0220				1	53·8272	0264	·0264	−[30·38]
½	72·8730	·8616	·0032	− 1·64	2	52·9927			
2	72·4539				2	45·1147			
2	54·6277				¼	45·0804	·2395	·0008	+ 8·35

Weighted mean .... − 0·31
V_a .... −20·16
V_d .... − ·14
Curvature .... − ·28

Radial velocity .... −20·9

α CORONÆ BOREALIS, 956 (*a*).

1907. July 20.
G. M. T. 16^h 07^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9731				2	45·3021	·2932	·0445	+46·59
1	72·8743	·8653	·0448	+65·09	1	27·5473	·5493	·0621	+54·03
1½	72·4128				3	27·3199			
2	45·2925								

Weighted mean .... +53·08
V_a .... −20·37
V_d .... − ·22
Curvature .... − ·28

Radial velocity .... +32·2

α CORONÆ BOREALIS, 963 (a).

1907. July 23.
G. M. T. 14h 32m

Observed by J. N. TRIBBLE.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
½	73·4670	....	....	....	½	54·0566	·0256	·0558	[+64·22]
1	72·8900	·8860	·0212	+30·76	2	50·0472	....	....	....
2	56·6944	....	....	....					

V_s		+30·76
V_a	−20·59	
V_d	− ·14	
Curvature	− ·28	
Radial velocity		+ 9·8

α CORONÆ BOREALIS, 973 (a).

1907. Aug. 1.
G. M. T. 14h 06m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Lines.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Lines.	Displacement in Revolutions.	Velocity.
2	72·9868	....	....	....	2	45·2780	....	....	....
½	72·8440	·8210	·0023	+ 3·34	1	45·2568	·2624	·0137	+14·34
2	72·4220	....	....	....					

Weighted mean	+10·67	
V_a		−20·98
V_d		− ·14
Curvature		− ·28
Radial velocity		−10·7

α CORONÆ BOREALIS, 973 (a)*.

1907. Aug. 1.
G. M. T. 14h 06m

Observed by W. E. HARPER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0088	....	....	....	½	53·9750	·9619	·0079	− 9·09
½	72·8800	·8807	·0159	+23·07	2	53·1240	....	....	....
2	72·4485	....	....	....	2	45·2885	....	....	....
2	54·7562	....	....	....	½	45·2552	·2402	·0015	+ 1·57

Weighted mean	+ 5·85	
V_a		−20·98
V_d		− ·14
Curvature		− ·28
Radial velocity		−15·5

* Check measurement.

α CORONÆ BOREALIS, 973 (b).

1907. Aug. 1. Observed by W. E. HARPER.
G. M. T. 14^h 20^m Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0342	....	....	....	½	45·2752	·2335	·0052	− 5·43
2	45·3153	....	....	....					

Vs....	− 5·43
Va....	−20·98
Vd....	− ·14
Curvature....	− ·28
Radial velocity....	−26 8

α CORONÆ BOREALIS, 978.

1907. Aug. 3. Observed by J. S. PLASKETT.
G. M. T. 13^h 02^m Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9938	....	....	....	2	45·2426	·2434	·0054	− 5·65
1	72·8526	·8224	·0037	+ 5·37	1	27·4524	·4800	·0165	− 6·40
2	72·4294	....	....	....	2	27·2940	....	....	....
2	45·2828	....	....	....					

Weighted mean....	− 3·08
Va....	−20·98
Vd....	− ·08
Curvature....	− ·28
Radial velocity....	−24·4

α CORONÆ BOREALIS, 986.

1907. Aug. 6. Observed by } W. E. HARPER.
G. M. T. 16^h 38^m Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9297	....	....	....	2	54·6972	....	....	....
1	72·8025	·8363	·0176	+25·57	1½	53·0647	....	....	....
1½	72·3657	....	....	....	2	45·2377	....	....	....
1	53·9672	·0000	·0434	+[50·08]	1	45·2437	·2877	·0390	+34·00

Weighted mean....		+29·78
Va....	−20·96	
Vd....	− ·27	
Curvature....	− ·28	
Radial velocity....		+ 8·3

α CORONÆ BOREALIS, 986.*

1907. Aug. 6.
G. M. T. 16^h 38^m

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9624	....	....	....	1	54·0154	54·0019	·0553	+[63·93]
1	72 8494	72·8504	·0317	+46·06	2	45·2934	....	....	....
2	72·3988	....	....	....	1½	45·2948	45·2850	·0363	+38·00
1	54·0288	....	....	....					

Weighted mean .... +41·22
V_a .... −20·96
V_d .... − ·27
Curvature .... − ·28

Radial velocity .... +19·7

*Check measurement.

α CORONÆ BOREALIS, 1006.

1907. Aug. 12.
G. M. T. 16^h 36^m

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·8216	....	....	....	1	53·9092	53·9903	·0205	+[23·66]
½	72·6801	72·8664	·0016	+ 2·32	2	45·2372	....	....	....
2	72·2641	....	....	....	½	45·2140	45·2504	·0117	+12·25
2	53·9477	....	....	....					

Weighted mean .... + 7 28
V_a .... −20·76
V_d .... − ·28
Curvature .... − ·28

Radial velocity .... −14·0

α CORONÆ BOREALIS, 1014.

1907. Aug. 15.
G. M. T. 15^h 09^m

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9915	....	....	....	2	53·9737	53·9813	·0115	+[13·24]
½	72·8396	72·8573	·0075	+10·88	2	53 1065	....	....	....
2	72·4290	....	....	....	2	45·2707	....	....	....
2	54·7321	....	....	....	½	45·2197	45·2226	·0161	+16·81

Weighted mean .... +13·84
V_a .... −20·58
V_d .... − ·24
Curvature .... − ·28

Radial velocity .... − 7·3

α CORONÆ BOREALIS, 1017.

1907. Aug. 22. G. M. T. 15h

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	45·7844	....	....	....	¼	45·7576	45·2448	·0061	+ 6·37

V_s	+ 6·37	
V_a		−19·90
V_d		− ·20
Curvature		− ·28
Radial velocity		−14·0

α CORONÆ BOREALIS, 1022.

1907. Aug. 23. G. M. T. 14h 46m

Observed by J. N. Tribble. Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	56·6754	....	....	....	2	45·2730	....	....	....
1	54·0042	53·9960	·0262	+[30·16]	½	45·2628	45·2634	·0247	+25·78
2	53·1214	....	....	....					

V_s		+25·78
V_a	−19·80	
V_d	− ·24	
Curvature	− ·28	
Radial velocity		+ 5·5

α CORONÆ BOREALIS, 1026.

1907. Aug. 27. G. M. T. 12h 06m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0220	....	....	....	2	45·2880	....	....	....
⅛	72·9344	72·9232	·0584	+84·74	⅛	27·4870	27·4500	·0281	+32·50
2	72·4630	....	....	....	2	27 2840	....	....	....
2	54·0444	....	....	....	⅛	45·2840	45·2696	·0310	+32·36
⅛	54·0000	53·9844	·0146	+[16·80]					

Weighted mean		+49·87
V_a	−19·35	
V_d	− ·19	
Curvature	− ·28	
Radial velocity		+30·0

α CORONÆ BOREALIS, 1032.

1907. Sept. 6.
G. M. T. 13^h 43^m

Observed by J. N. Tribble.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0155	....	....	....	2	45·2322	....	....	....
¼	72·8710	72·8631	·0017	− 2·46	1	45·1848	45·2273	·0114	−13·05
2	72·4595	....	....	....	½	27·3558	27·4204	·0078	+ 6·77
2	54·7134	....	....	....	2	27·1818	....	....	....
½	53·9360	53·9634	·0064	− [7·36]	¼	11·7425	11·8493	·0021	− 1·57
2	53·0852	....	....	....	2	11·4098	....	....	....

Weighted mean.......... − 4·50
V_a .... −17·34
V_d .... − ·25
Curvature.......... − ·28

Radial velocity.......... − 22·4

α CORONÆ BOREALIS, 1037.

1907. Sept. 12.
G. M. T. 14^h 40^m

Observed by J. N. Tribble.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9383	....	....	....	1	45·1575	45·2878	·0491	+51·20
1½	72·8230	72·8950	·0302	+43·82	½	27·3467	27·5090	·0964	+83·52
2	72·3715	....	....	....	2	27·0843	....	....	....
2	45·1433	....	....	....					

Weighted mean.......... +52·93
V_a .... −16·20
V_d .... − ·28
Curvature.......... − ·28

Radial velocity.......... +36·2

α CORONÆ BOREALIS, 1047.

1907. Sept. 18.
G. M. T. 12^h 50^m

Observed by J. N. Tribble.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·1431	....	....	....	2	45·3762	....	....	....
1	72·9930	72·8596	·0052	− 7·55	1	45·3585	45·2560	·0173	+18·06
1½	72·5787	....	....	....					

Weighted mean.......... + 5·25
V_a .... −14·94
V_d .... − ·25
Curvature.......... − ·28

Radial velocity.......... −10·2

α CORONÆ BOREALIS, 1048.

1907. Sept. 18.
G. M. T. 13^h 16^m

Observed by J. N. Tribble.
Measured by W. E. Harper and J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0030	....	....	....	½	53·9418	53·9718	·0020	+ [2·30]
½	72·8640	72·8695	·0047	+ 6·82	2	53·0866	....	....	....
2	72·4433	....	....	....	2	45·1702	....	....	....
2	57·8023	....	....	....	1	45·1457	45·2339	·0048	− 5·00
1	57·7850	57·7895	·0373	−(44·91)	¼	27·3310	27·3870	·0256	−22·22
2	54·7113	....	....	....	2	27·1905	....	....	....

Weighted mean	− 4·09
V_a	−14·94
V_d	− ·28
Curvature	− ·28
Radial velocity	−19·6

α CORONÆ BOREALIS, 1060.

1907. Sept. 20.
G. M. T. 13^h 35^m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0090	....	....	....	2	53·0627	....	....	....
¼	72·8367	72·8376	·0272	−39·46	2	45·2140	....	....	....
2	72·4435	....	....	....	1	45·1690	45·2286	·0101	−10·54
2	54·6952	....	....	....	½	27·3412	27·4192	·0066	+ 5·73
¼	53·8872	53·9352	·0346	−[39·82]	2	27·1682	....	....	....

Weighted mean	−10·02
V_a	−14·52
V_d	+ ·02
Curvature	− ·28
Radial velocity	−24·8

a CORONÆ BOREALIS, 1083.

1907. October 1. Observed by W. E. HARPER.
G. M. T. 13h 44m Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0679	....	....	....	2	45·3609	....	....	....
¼	72·9652	72·9078	·0430	+62·39	½	45·3694	45·2857	·0470	+49·07
2	72·5002	....	....	....	¼	27·5686	27·4492	·0366	+31·77
2	54·8129	....	....	....	2	27·3664	....	....	....
½	54·0989	54·0261	·0563	+[64·80]	1	12·0432	11·9027	·0513	+38·42
2	53·1867	....	....	....	2	11·6482	....	....	....

Weighted mean .... +43·25
V_a .... −12·21
V_d .... − ·28
Curvature .... − ·28

Radial velocity .... +30·5

a CORONÆ BOREALIS, 1084.

1907. Oct. 1. Observed by W. E. HARPER.
G. M. T. 13h 56m Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9948	....	....	....	2	45·2968	....	....	....
¼	72·8698	72·8852	·0204	+29·60	½	45·2912	45·2680	·0293	+30·59
2	72·4285	....	....	....					

Weighted mean .... +30·27
V_a .... −12·21
V_d .... − ·28
Curvature .... − ·28

Radial velocity .... +17·5

a CORONÆ BOREALIS, 1393.

1908. March 9. Observed by } W. E. HARPER.
G. M. T. 22h 08m Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·8725	....	....	....	2½	27·5088	27·4056	·0070	− 6·08
1½	54·0542	53·9269	·0429	−[49·38]	3	27·3499	....	....	....
2	53·2361	....	....	....	1½	11·9342	11·8522	·0008	+ 0·60
3	45·3847	....	....	....	3	11·5892	....	....	....
2	45·3252	45·2141	·0246	−25·68					

Weighted mean .... −10·94
V_a .... +16·98
V_d .... − ·05
Curvature .... − ·28

Radial velocity .... + 5·7

α CORONÆ BOREALIS, 1393*.

1908. March 9.
G. M. T. 22^h 08^m

Observed by W. E. HARPER.
Measured by C. R. WESTLAND.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	54·7344	....	....	....	1	27·3712	27·3992	·0134	−11·63
2	53·9241	53·9316	·0382	−[43·97]	2	27·2184	....	....	....
2	53·1045	....	....	....	1	11·7835	11·8301	·0213	−15·95
2	45·2517	....	....	....	2	11·4603	....	....	....
2	45·1867	45·2087	·0300	−31·32					

Weighted mean		−22·55
V_a	+16·98	
V_d		− ·05
Curvature		− ·28
Radial velocity		− 5·9

Note.—(Mg. line omitted).

* Check measurement.

α CORONÆ BOREALIS, 1393. *

1908. March 9.
G. M. T. 22^h 08^m

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7502	....	....	....	1½	45·2112	45·2051	·0336	−35·08
1	53·9539	53·9413	·0285	−[32·80]	1	27·3758	27·3827	·0299	−25·95
2	53·1290	....	....	....	2	27·2397	....	....	....
2	45·2797	.....	....	....					

Weighted mean		−31·43
V_a	+16·98	
V_d		− ·05
Curvature		− ·28
Radial velocity		− 14·8

* Check measurement.

α CORONÆ BOREALIS, 1402.

1908. March 16.
G. M. T. $21^h\ 02^m$

Observed by / Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	54·7845	...	...	...	1	27·5345	27 3875	·0251	-21·79
1	53·9802	53·9412	·0286	-[32·92]	2	27·3906	...	...	...
1	53·1475	...	...	...	1½	11.9963	11·7940	·0574	-43·00
1	45·3466	...	...	...	2	11·7098	...	...	...
1	45·2690	45·1960	·0427	-44·58					

Weighted mean	-37·39
V_a ... +20·74	
V_d	·00
Curvature	- ·28
Radial velocity	- 16·9

α CORONÆ BOREALIS, 1493.

1908. April 15.
G. M. T. $19^h\ 18^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	45·2842	...	...	...	2	15·5026	...	...	...
1	45·2361	45·2254	·0133	-13·88	½	15·5417	15·4377	·0356	-27·55
1	27·4702	27·4039	·0087	- 7·55	1½	11·9500	11·8426	·0088	- 6·59
2	27·3135	...	...	...	2	11·6149	...	...	...

Weighted mean	-13·89
V_a ... + 5·85	
V_d	- ·04
Curvature	- ·28
Radial velocity	- 8·4

α CORONÆ BOREALIS, 1493.*

1908. April 15.
G. M. T. $19^h\ 18^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9717	...	...	...	2	45·2267	45·2191	·0196	-20·46
1½	72·8300	72·8678	·0030	+ 4·35	1½	27·4633	27·4012	·0114	- 9·89
2	72·4080	...	...	...	2	27·3090	...	...	...
2	45·2812	...	...	...					

Weighted mean	- 9·85
V_a ... + 5·85	
V_d	- ·04
Curvature	- ·28
Radial velocity	- 4·3

*Check measurement.

α CORONÆ BOREALIS, 1565.

1908. June 1. Observed by T. H. Parker.
G. M. T. 18^h Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9938	...	...	...	2	45·3014	...	...	...
1½	72·8490	72·8648	·0000	± 0·00	1	27·4890	27·4251	·0125	+10·85
2	72·4310	...	...	...	2	27·3107	...	...	...
2	54·7550	...	...	...	½	15·5442	15·4528	·0105	− 8·13
1	54·0110	53·9920	·0222	+[25·56]	2	15·4900	...	...	...
2	53·1370	...	...	...	2	11·9275	11·8338	·0176	− 9·13
2	45·2605	45·2355	·0032	− 3·34	2	11·6009	...	...	...

Weighted mean	− 2·59
V_a	−10·43
V_d	− ·20
Curvature	− ·28
Radial velocity	−13·5

α CORONÆ BOREALIS, 1566.

1908. June 1. Observed by } T. H. Parker.
G. M. T. 18^h 42^m Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	45·2929	...	...	...	½	27·4641	27·4107	·0019	− 1·64
2	45·2461	45·2267	·0120	−12·52	2	27·3000	...	...	...
2	43·5585	...	...	...					

Weighted mean	−10·34
V_a	−10·43
V_d	− ·20
Curvature	− ·28
Radial velocity	− 20·2

α CORONÆ BOREALIS, 1571.

1908. June 3. Observed by J. S. Plaskett.
G. M. T. 16^h 32^m Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0427	...	...	...	1	27·4899	27·4253	·0127	+11·02
1	72·9099	72·9760	·0112	+16·25	2	27·3115	...	...	...
½	72·4822	...	...	...	½	15·5378	15·4464	·0269	−20·82
2	45·2815	...	...	...	2	15·4900	...	...	...
2	45·2437	45·2358	·0029	− 3·03					

Weighted mean	+ 2·40
V_a	− 11·02
V_d	− ·07
Curvature	− ·28
Radial velocity	− 9·0

α CORONÆ BOREALIS, 1572.

1908. June 3.
G. M. T. 16^h 52^m

Observed by J. S. Plaskett.
Measured by C. R. Westland.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7690	....	....	....	2	27·3380	....	....	....
½	53·9965	53·9706	·0008	+ [1·16]	½	15·5674	15·4394	·0339	−26·24
2	53·1417	....	....	....	2	15·5266	....	....	....
2	45·3179	....	....	....	2	11·9767	11·8434	·0080	− 5·99
2	45·2866	45·2423	·0036	+ 3·76	2	11·6410	....	....	....
½	27·4982	27·4073	·0053	− 4·60					

Weighted mean	− 3·98
V_a	−11 02
V_d	− ·08
Curvature	− ·28
Radial velocity	− 15·4

α CORONÆ BOREALIS, 1572*.

1908. June 3.
G. M. T. 16^h 52^m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
½	53·9962	53·9677	·0021	−[2·41]	2	27·3409	....	....	....
2	54·7700	....	....	....	1	15·5560	15·4260	·0473	−36·61
2	45·3195	....	....	....	2	15·5286	....	....	....
1	45·2856	45·2396	·0009	+ 0·93	2	11·9830	11·8501	·0013	− 9·74
2	43·5855	....	....	....	2	11·6401	....	....	....
2	27·5096	27·4153	·0027	+ 2·34					

Weighted mean	− 8·41
V_a	−11 02
V_d	− ·08
Curvature	− ·28
Radial velocity	− 19 8

* Check measurement.

α CORONÆ BOREALIS, 1581.

1908. June 5.
G. M. T. 17h 31m

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9780	...	...	...	1	27·3975	27·4026	·0100	− 8·68
1	72·8406	72·8688	·0040	+ 5·80	2	27·2433	...	...	...
2	72·4202	...	...	...	1	11·8584	11·8491	·0023	− 1·72
2	45·2545	...	...	...	2	11·5145	...	...	...
2	45·2387	45·2578	·0191	+19·94					

Weighted mean	+ 7·06
V_a	−11·62
V_d	− ·14
Curvature	− ·28
Radial velocity	− 5·0

α CORONÆ BOREALIS, 1601.

1908. June 12.
G. M. T. 16h 56m

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9665	...	...	...	2	53·0720	...	...	...
1	72·8330	72·8678	·0030	+ 4·35	2	45·2242	45·2568	·0181	+28·18
1	72·4060	...	...	...	2	45·2410	...	...	...
2	54·7068	...	...	...	1½	27·4228	27·4370	·0244	+21·27
½	53 9350	53·9725	·0027	+ [3·11]	2	27·2322	...	...	...

Weighted mean	+20·58
V_a	−13·59
V_d	− ·12
Curvature	− ·28
Radial velocity	+ 6·6

α CORONÆ BOREALIS, 1608.

1908. June 17.
G M. T. 13^h 53^m

Observed by } Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9809	......	....	....	2	45·2620	....	....	....
1	72·8361	72·8662	·0014	+ 2·03	2	45·2390	45·2506	·0119	+12·42
2	72·4112	....	....	....	1	27·4892	27·4739	·0613	+53·21
2	54·7169	....	.....	....	2	27·2621	....	....	....
1	53·9506	53·9716	·0018	+ [2·07]	1	11·9270	11·8964	·0450	+33·70
2	53·0941	....	....	....	2	11·5379	....	....	....

Weighted mean.................. ... +23·76
V_a.. . ... −14·85
V_d.... .... − ·07
Curvature............. − ·28

Radial velocity..................... + 8·6

α CORONÆ BOREALIS, 1623.

1908. June 22.
G. M. T. 16^h 27^m

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7556	....	....	....	1	27·4580	27·4130	·0004	+ 3·47
2	53·9719	53·9559	·0139	−[16·00]	3	27·2899	....	....	....
2	53·1320	....	....	....	1	11·9219	11·8454	·0060	− 4·49
2	45·2819	....	....	....	2	11·5853	....	....	....
1	45·2571	45·2511	·0124	+12·93					

Weighted mean............ + 3·97
V_a.............................. −16·16
V_d.............................. − ·16
Curvature...................... − ·28

Radial velocity .... −12·

α CORONÆ BOREALIS, 1623.*

1908. June 22.
G. M. T. 16h 27m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0044				2	45·3000			
1	72·8548	72·8598	·0050	− 7·25	1	45·2624	45·2364	·0023	− 2·40
2	72·4483				1	27·4675	27·4195	·0024	− 2·08
2	54·7536				3	27·2952			
2	53·9681	53·9531	·0167	−[19·22]	1	11·9274	11·8594	·0080	+ 5·99
2	53·1381				2	11·5790			

Weighted mean........ − 1·44
V_a........ −16·16
V_d........ − ·16
Curvature........ − ·28

*Check measurement.

Radial velocity........ −18·0

α CORONÆ BOREALIS, 1624.

1908. June 22.
G. M. T. 16h 40m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	54·7898				½	27·4840	27·4175	·0049	+ 4·34
1	54·0178	53·9700	·0002	±[0·00]	2	27·3131			
2	53·1597				1½	11·9423	11·8612	·0098	+ 7·34
2	45·3251				2	11·5883			
1½	45·2880	45·2365	·0023	− 2·40					

Weighted mean........ + 4·02
V_a........ −16·16
V_d........ − ·16
Curvature........ − ·28

Radial velocity........ −12·6

α CORONÆ BOREALIS, 1628.

1908. June 24.
G. M. T. 15h 26m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7838				1	27·4598	27·4158	·0032	+ 2·7
½	53·9417	53·9000	·0698	−[80·33]	2	27·2908			
2	53·1536				1½	11·9065	11·8705	·0191	+14·30
2	45·3060				2	11·5432			
1	45·2761	45·2436	·0049	+ 5·12					

Weighted mean........ + 8·38
V_a........ −16·65
V_d........ − ·07
Curvature........ − ·28

Radial velocity........ − 8·6

α CORONÆ BOREALIS, 1629.

1908. June 24.
G. M. T. 15h 49m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0846	....	....	....	2	45·3268	....	....	....
½	72·9449	72·8698	·0050	+ 7·26	1	45·2795	45·2263	·0124	−12·95
1	72·5206	....	....	....	½	27·4625	27·4000	·0126	−10·93
2	54·7999	....	....	....	2	27·3093	....	....	....
1½	54·0511	53·9939	·0241	+[27·74]	1	11·9286	11·8711	·0197	+14·77
2	53·1682	....	....	....	2	11·5643	....	....	....

Weighted mean	0·00
V_a	−16·66
V_d	− ·11
Curvature	− ·28
Radial velocity	−17·0

α CORONÆ BOREALIS, 1638.

1908. June 26.
G. M. T. 15h 51m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0800	....	....	....	1½	45·3098	45·2238	·0149	−15·56
1	72·9496	72·8476	·0172	−24·96	2	45·3565	....	....	....
1	72·5498	....	....	....	2	27·4673	27·3933	·0193	−16·80
2	54·8334	....	....	....	3	27·3236	....	....	....
1	54·0511	53·9601	·0097	−[11·31]	2	11·9232	11·8627	·0113	+ 8·46
2	53·2007	....	....	....	3	11·5652	....	....	....

Weighted mean	−10·00
V_a	−14·50
V_d	− ·11
Curvature	− ·28
Radial velocity	−24·9

α CORONÆ BOREALIS, 1639.

1908. June 26th.
G. M. T. 15h 51m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0632	....	....	....	2	53·1470	....	....	....
1	72·9112	72·8562	·0086	−12·48	2	45·3037	....	....	....
1	72·5014	....	....	....	1⅓	45·2656	45·2376	·0011	− 1·15
1½	54·7831	....	....	....	1½	27·4499	27·4169	·0043	+ 3·73
1	54·0126	53·9776	·0078	+[8·98]	2	27·2799	....	....	....

Weighted mean	− 2·40
V_a	−14·81
V_d	− ·11
Curvature	− ·28
Radial velocity	− 17·6

α CORONÆ BOREALIS, 1646,

1908. June 27.
G. M. T. 16h 20m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings	Displacement in Revolutions.	Velocity.
1½	73·0138	....	....	....	1	45·2252	45·2282	·0105	−10·95
½	72·8550	72·8552	·0096	−13·92	2	45·2694	....	....	....
1½	72·4403	....	....	....	1½	27·4472	27·4290	·0164	+14·23
2	54·7419	....	....	....	3	27·2648	....	....	....
1	53·9706	53·9751	·0053	+[6·17]	2	11·8531	11·8231	·0283	−21·19
2	53·0627 (?)	....	....	....	3	11·5348	....	....	....

Weighted mean	− 7·79
V_a	−14·98
V_d	− ·11
Curvature	− ·28
Radial velocity	− 23·2

α CORONÆ BOREALIS, 1646*.

1908. June 27.
G. M. T. 16h 20m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0388	....	....	....	2	45·2924	....	....	....
½	72·8666	72·8466	·0182	−26·41	1½	45·2510	45·2325	·0062	− 6·41
1½	72·4615	....	....	....	1½	27·4381	27·4092	·0034	− 3·05
2	54·7608	....	....	....	3	27·2754	....	....	....
½	54·0203	54·0038	·0340	+[39·13]	1	11·9032	11·8575	·0061	+ 5·29
2	53·1283	....	....	....	3	11·5531	....	....	....

Weighted mean	− 4·91
V_a	−14·98
V_d	− ·11
Curvature	− ·28
Radial velocity	− 20·3

* Check measurement.

α CORONÆ BOREALIS, 1646.*

1908. June 27.
G. M. T. 16ʰ 20ᵐ

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
	72·9272	....	....	....	2	45·1872	....	....	....
	92·7747	72·8581	·0067	− 8·72	2	45·1430	45·2294	·0093	− 9·71
1	73·3578	....	....	....	1	27·3550	27·4286	·0160	+13·89
	54·6545	....	....	....	2	27·1731	....	....	....
½	53·8697	53·9617	·0081	−[9·32]	1	11·7667	11·8341	·0173	−12·96
	53·0153	....	....	....	2	11·4398	....	....	....

Weighted mean	− 5·44
V_a	−14·98
V_d	− ·11
Curvature	− ·28
Radial velocity	− 20·8

* Check measurement.

α CORONÆ BOREALIS, 1647.

1908. June 27.
G. M T. 16ʰ 40ᵐ

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0577	....	....	....	2	45·3388	....	....	....
½	72·9089	72·8589	·0059	− 8·56	1	45·3041	45·2387	·0000	± 0·00
1	72·5000	....	....	....	1	27·4771	27·3891	·0235	−20·40
2	54·7978	....	....	....	2	27·3349	....	....	....
1	54·0373	53·9793	·0095	−[10·93]	1	11·9502	11·8522	·0008	+ 0·60
2	53·1731	....	....	....	2	11·6053	....	....	....

Weighted mean	− 6·59
V_a	−14·03
V_d	− ·16
Curvature	− ·28
Radial velocity	−21·1

α CORONÆ BOREALIS, 1652.

1908. July 1.
G. M. T. 15ʰ 15ᵐ

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	....	....	....	....	1	45·0548	45·3038	·0651	+67·96
½	72·6304	72·8917	·0269	+38·03	2	45·0254	....	....	....
1	72·1836	....	....	....	1	27·2466	27·4801	·0675	+58·59
2	54·4896	....	....	....	2	27·0134	....	....	....
½	53·7812	53·0387	·0689	+[79·30]	1	11·7141	11·9391	·0877	+64·69
2	52·8512	....	....	....	2	11·2829	....	....	....

Weighted mean		+60·07
V_a	−17·78	
V_d	− ·07	
Curvature	− ·28	
Radial velocity		+41·9

α CORONÆ BOREALIS, 1656.

1908. July 3. G. M. T. 15h 17m

Observed by W. E. Harper. Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
½	54·7645				½	27·4941	27·4806	·0680	+59·02
1½	54·0431	54·0196	·0498	+[57·32]	2	27·2599			
1	53·1362				½	11·8955	11·8895	·0381	+28·54
1	45·2983				2	11·5115			
½	45·3190	45·2943	·0556	+58·05					

Weighted mean		+48·53
V_a	−18·18	
V_d	− ·11	
Curvature	− ·28	
Radial velocity		+30·0

α CORONÆ BOREALIS, 1657.

1908. July 3. G. M. T. 15h 30m

Observed by W. E. Harper. Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
½	54·6727				1	45·2097	45·2817	·0430	+44·89
½	53·9471	54·0011	·0313	+36·03	2	44·1900			
½	53·0497				1	27·3961	27·4586	·0460	+39·93
1	45·2008				2	27·1843			

Weighted mean		+42·41
V_a	−18·18	
V_d	− ·14	
Curvature	− ·28	
Radial velocity		+23·8

α CORONÆ BOREALIS, 1665.

1908. July 6. G. M. T. 16h 50m

Observed by T. H. Parker. Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9602				1½	45·2173	45·2668	·0281	+29·34
½	72·8398	72·8876	·0228	+33·08	2	45·2240			
1	72·3996				1	27·4083	27·4290	·0164	+14·24
2	54·6898				2	27·2265			
¼	53·9145	53·9715	·0017	+ [1·96]	1	11·8914	11·9154	·0640	+47·93
2	53·0501				2	11·4830			

Weighted mean		+31·18
V_a	−18·72	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+12·0

α CORONÆ BOREALIS, 1673.

1908. July 8.
G. M. T. 14h 59m

Observed by / Measured by } J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9993	....	....	....	2	45·2746	....	....	....
½	72·8626	72·8721	·0073	+10·60	1	45·2392	45·2382	·0005	− 0·52
1	72·4371	....	....	....	½	27·4564	27·4227	·0065	+ 5·64
2	54·7344	....	....	....	2	27·2810	....	....	....
½	53·9855	53·9920	·0222	+[25·55]	1½	11·9283	11·8883	·0369	+27·63
2	53·1071	....	....	....	1	11·5472	....	....	....

Weighted mean	+14·01
V_a	−19·07
V_d	− ·11
Curvature	− ·28
Radial velocity	− 5·4

α CORONÆ BOREALIS, 1674.

1908. July 8.
G. M. T. 15h 11m

Observed by / Measured by } J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7242	....	....	....	1	27·4496	27·4334	·0208	+18·05
1	53·9536	53·9711	·0013	+[1·50]	2	27·2631	....	....	....
2	53·0947	....	....	....	1½	11·8926	11·8651	·0137	+10·26
2	45·2616	....	....	....	2	11·5351	....	....	....
1	45·2583	45·2703	·0316	+32·99					

Weighted mean	+18·98
V_a	−19·07
V_d	− ·11
Curvature	− ·28
Radial velocity	− 0·5

α CORONÆ BOREALIS, 1683.

1908. July 10.
G. M. T. 13h 34m

Observed by W. E. HARPER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0309	....	....	....	2	53·1334	....	....	....
½	72·8884	72·8694	·0046	+ 6·67	2	45·3129	....	....	....
1	72·4603	....	....	....	½	45·2667	45·2274	·0113	−11·79
2	54·7682	....	....	....	1	27·4832	27·4112	·0014	− 1·22
1	54·0451	54·0211	·0513	+[59·04]	2	27·3188	....	....	....

Weighted mean	− 1·89
V_a	−19·38
V_d	·00
Curvature	− ·28
Radial velocity	− 21·5

α CORONÆ BOREALIS, 1684.

1908. July 10.
G. M. T. 13^h 57^m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0327	....	....	....	2	45·3009	....	....	....
½	72·8947	72·8737	·0089	+12·91	1	45·2694	45·2421	·0034	+ 3·54
1	72·4598	....	....	....	1½	27·4744	27·4221	·0095	+ 7·81
2	54·7653	....	....	....	2	27·2995	....	....	....
½	53·9629	53·9399	·0299	−[34·41]	½	11·9048	11·8363	·0151	−11·30
2	53·1347	....	....	....	2	11·5759	....	....	....

Weighted mean .... + 4·59	
V_a	−19·38
V_d	− ·04
Curvature	− ·28
Radial velocity	−15·1

α CORONÆ BOREALIS, 1697.

1908. July 13.
G. M. T. 15^h 36^m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9735	....	....	....	2	45·2596	....	....	....
½	72·8268	72 8608	·0040	− 5·80	1½	45·2284	45·2424	·0037	+ 3·86
1	72·4159	....	....	....	1½	27·4218	27·3975	·0151	−13·11
2	54·7199	....	....	....	2	27·2712	....	....	....
1	53·9583	53·9828	·0130	+[14·96]	1	11·8656	11·8236	·0278	−20·82
2	53·0846	....	....	....	2	11·5495	....	....	....

Weighted mean	− 8·35
V_a	−19·79
V_d	− ·19
Curvature	− ·28
Radial velocity	−28·6

α CORONÆ BOREALIS, 1698.

1908. July 13.
G. M. T. 15^h 42^m

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0061	....	....	....	2	45·2766	......	....	....
½	72·8661	72·8691	·0043	+ 6·24	1½	45·2388	45·2358	·0029	− 3·03
1	72·4437	....	....	....	1½	27·4391	27·4144	·0018	+ 1·56
2	54·7384	....	....	....	2	27·2716	....	....	....
1	53·9504	53·9544	·0154	−[17·72]	1	11·8994	11·8619	·0105	+ 7·86
2	53·1069	....	....	....	2	11·5450	....	....	....

Weighted mean................	+ 1·84	
V_a..............................		−19·79
V_d..............................		− ·16
Curvature..........................		− ·28
Radial velocity....................		−18·4

α CORONÆ BOREALIS, 1711.

1908. July 15.
G. M. T. 16^h 24^m

Observed by }
Measured by } J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0341	....	....	....	1½	45·2779	45·2420	·0033	+ 3·44
½	72·8891	72·8647	·0001	− ·15	1	27·4705	27·4115	·0011	− ·95
2	54·7729	....	....	....	2	27·3061	....	....	....
1½	54·0318	53·9990	·0292	+[33·61]	1	11·9256	11·8468	·0046	− ·34
2	53·1470	....	....	....	2	11·5865	....	....	....
2	45·3094	....	....	....					

Weighted mean................	+ 3·79	
V_a..............................		−20·03
V_d..............................		− ·22
Curvature..........................		− ·28
Radial velocity....................		−16·7

α CORONÆ BOREALIS, 1721.

1908. July 24.
G. M. T. $13^h\ 05^m$

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0620	....	....	....	2	45·3273	....	....	....
½	72·9251	72·9711	·0063	+ 9·14	1	45·3040	45·2503	·0116	+12·10
1	72·5018	....	....	....	1½	27·5037	27·4317	·0191	+15·57
2	54·7950	....	....	....	2	27·3187	....	....	....
½	54·0282	53.9742	·0044	+ [5·06]	1	11·9502	11·8812	·0298	+20·97
2	53·1587	....	....	....	2	11·5759	....	....	....

Weighted mean............ +15·25	
V_a	−20·68
V_d	− ·04
Curvature..........................	− ·28
Radial velocity..........................	− 5·7

α CORONÆ BOREALIS, 1722.

1908. July 24.
G. M. T. $13^h\ 21^m$

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0441	....	....	....	2	45·3021	....	....	....
½	72·9200	72·8872	·0224	+32·50	1½	45·3022	45·2738	·0351	+36·64
1	72·4735	....	....	....	1	27·4681	27·4298	·0172	+14·93
2	54·7704	....	....	....	2	27·2830	....	....	....
¼	54·0159	53·9881	·0183	+[21·06]	1	11·9141	11·8766	·0252	+18·87
2	53·1390	....	....	....	2	11·5446	....	....	....

Weighted mean..........................	+26·25
V_a .... −20·68	
V_d .... − ·04	
Curvature.......................... − ·28	
Radial velocity..........................	+ 5·25

α CORONÆ BOREALIS, 1739.

1908. July 29. Observed by J. S. Plaskett.
G. M. T. 15^h 34^m Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0080	...	...	...	2	45·2276	...	...	...
½	72·8406	72·8439	·0209	−30·33	½	45·1618	45·2078	·0309	−32·26
2	72·4370	...	...	...	½	27·3167	27·3607	·0519	−45·14
2	54·7106	...	...	...	2	27·1926	...	...	...
1	53·9688	54·0038	·0340	−[39·13]	¼	11·7853	11·8623	·0109	+ 8·16
2	53·0733	...	...	...	2	11·4290	...	...	...

Weighted mean	−29·78
V_a	−20·68
V_d	− ·24
Curvature	− ·28
Radial velocity	−50·0

α CORONÆ BOREALIS, 1739.*

1908. July 29. Observed by J. S. Plaskett.
G. M. T. 15^h 34^m Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0854	...	...	...	2	45·3015	...	...	...
½	72·9133	72·8398	·0250	−36·27	1	45·2452	45·2173	·0214	−22·34
2	72·5142	...	...	...	¼	27·3747	27·3581	·0545	−36·29
2	54·7789	...	...	...	2	27·2632	...	...	...
½	54·0256	53·9903	·0205	+[25·59]	1	11·8647	11·8697	·0183	+13·70
2	53·1456	...	...	...	2	11·5022	...	...	...

Weighted mean	−18·01
V_a	−20·91
V_d	− ·22
Curvature	− ·28
Radial velocity	−39·4

*Check measurement.

α CORONÆ BOREALIS, 1748.

1908. July 31.
G. M. T. 13h 38m

Observed by T. H. PARKER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0081	....	....	....	2	53·1007	....	....	....
½	72·8616	72·8641	·0007	−10·15	2	45·2666	....	....	....
1	72·4501	....	....	....	1	45·1969	45·2039	·0348	−36·33
2	54·7326	....	....	......	1½	27·3938	27·3994	·0132	−11·45
1	53·9342	53·9445	·0250	−[28·77]	2	27·2521	....	....	....

Weighted mean	−19·53
V_a	−20·98
V_d	− ·14
Curvature	− ·28
Radial velocity	−40·9

α CORONÆ BOREALIS, 1749.

1908. July 31.
G. M. T. 13h 38m

Observed by T. H. PARKER.
Measured by J. B. CANNON.

Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0321	....	....	....	2	45·2724	....	....	....
½	72·8767	72·8559	·0089	−11·91	1½	45·2269	45·2281	·0106	−11·07
1	72·4611	....	....	......	1	27·4144	27·4088	·0038	− 3·30
2	54·7470	....	....	....	2	27·2523	....	....	....
1	53·9854	53·9816	·0118	+[13·58]	1	11·8314	11·8384	·0160	−11·98
2	53·1145	....	....	... .	2	11·4999	....	....	....

Weighted mean	− 9·46
V_a	−20·98
V_d	− ·14
Curvature	− ·28
Radial velocity	− 30·9

α CORONÆ BOREALIS, 1764.

1908. Aug. 5.
G. M. T. $15^h 15^m$

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0055	....	....	....	2	45·2722	....	....	....
¼	72·9250	72·9281	·0633	+91·85	1½	45·2899	45·2913	·0526	+54·91
1	72·4451	....	....	....	½	27·4955	27·4728	·0602	+52·25
2	54·7359	....	....	....	2	27·2595	....	....	....
1	54·0637	54·0699	·1002	+[115·33]	1	11·9402	11·9365	·0851	+63·74
2	53·1055	....	....	....	2	11·5107	....	....	....

Weighted mean........................		+58·42
V_a..............................	−20·96	
V_d..............................	− ·23	
Curvature..........................	− ·28	
Radial velocity....................		+ 37·0

α CORONÆ BOREALIS, 1773.

1908. Aug. 7.
G. M. T. $14^h 25^m$

Observed by T. H. PARKER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7903	....	....	....	½	27·5854	27·5087	·0961	+83·41
1	54·0770	54·0281	·0583	+[67.10]	2	27·3236	....	....	....
2	53·1613	....	....	....	½	12·0157	11·9397	·0883	+66·14
2	45·3261	....	....	....	2	11·5833	....	....	....
1½	45·3538	45·3013	·0626	+65·35					

Weighted mean......................		+69·12
V_a..............................	−20·91	
V_d..............................	− ·19	
Curvature..........................	− ·28	
Radial velocity....................		+47·7

α CORONÆ BOREALIS, 1775.

1908. Aug. 7.
G. M. T. 14h 40m

Observed by T. H. Parker.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0279	....	....	....	2	45·3045	....	....	....
¼	72·9227	72·9056	·0408	+58·20	1½	45·3313	45·3004	·0617	+64·41
1	72·4568	....	....	....	1	27·5296	27·4692	·0566	+49·13
2	54·7633	....	....	....	2	27·3107	....	....	....
1	54·0103	53·9888	·0190	+[21·87]	1	12·0051	11·9305	·0791	+59·25
2	53·1363	....	....	....	2	11·5821	....	....	....

Weighted mean		+58·54
V_a	−20·91	
V_d	− ·19	
Curvature	− ·28	
Radial velocity		+37·5

α CORONÆ BOREALIS, 1798.

1908. Aug. 20.
G. M. T. 13h 05m

Observed by T. H. Parker.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0365	....	....	....	2	53·1332	....	....	....
½	72·8789	72·8528	·0120	−17·41	2	45·2876	....	....	....
1	72·4693	....	....	....	1	45·2516	45·2376	·0011	− 1·15
2	54·7634	....	....	....	½	27·4337	27·4011	·0115	− 9·98
1	54·0034	53·9821	·0123	+[14·16]	2	27·2794	....	....	....

Weighted mean	− 7·42
V_a	−20·11
V_d	− ·16
Curvature	− ·28
Radial velocity	− 28·0

a CORONÆ BOREALIS, 1798*

1908. Aug. 20.
G. M. T. $13^h\ 05^m$

Observed by T. H. Parker.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0592	....	....	....	2	45·3184	....	....	....
½	72·9039	72·8549	·0099	−14·36	1	45·2919	45·2471	·0084	+ 8·76
2	72·4926	....	....	....	1	27·4682	27·4132	·0006	+ 0·52
2	54·7899	....	....	....	2	27·3016	....	....	....
½	54·0289	53·9824	·0126	+[14·50]	1	11·9196	11·8679	·0165	+12·36
2	53·1569	....	....	....	2	11·5585	....	....	....

Weighted mean	+ 4·13
V_a	−20·11
V_d	− ·16
Curvature	− ·28
Radial velocity	− 16·4

* Check measurement.

a CORONÆ BOREALIS, 1809.

1908. Aug. 21.
G. M. T. $15^h\ 01^m$

Observed by } J. B. Cannon.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions	Velocity.
1	73·0208	....	....	....	2	45·2855	....	....	....
½	72·8951	72·8835	·0187	+27·13	1	45·2607	45·2488	·0101	+10·54
1	72·4582	....	....	....	½	27·4744	27·4424	·0298	+25·87
2	54·7565	....	....	....	2	27·2787	....	....	....
¼	54·0087	53·9964	·0266	+[30·62]	1	11·9107	11·8762	·0248	+18·58
2	53·1219	....	....	....	2	11·5418	....	....	....

Weighted mean	+ 18·54
V_a	−20·00
V_d	− ·25
Curvature	− ·28
Radial velocity	− 2·00

α CORONÆ BOREALIS, 1816.

1908. Aug. 24.
G. M. T. 13^h 12^m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7497	....	....	....	1	45·3087	45·2922	·0535	+55·85
½	54·0267	54·0182	·0484	+[55·71]	½	27·5152	27·4672	·0546	+47·38
2	53·1212	....	....	....	2	27·2950	....	....	....
2	45·2902	....	....	....					

Weighted mean .... +53·03
V_a .... −19·63
V_d .... − ·20
Curvature .... − ·28

Radial velocity .... + 32·9

α CORONÆ BOREALIS, 1817.

1908. Aug. 24.
G. M. T. 13^h 27^m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0283	....	....	....	2	45·2794	....	....	....
½	72·9461	72·9283	·0635	+92·13	1	45·2977	45·2920	·0583	+55·64
1	72·4579	....	....	....	½	27·5221	27·5085	·0959	+83·24
2	54·7488	....	....	....	2	27·2603	....	....	....
1	54·0279	54·0227	·0529	+[62·66]	½	11·9477	11·9257	·0743	+55·65
2	53·1145	....	....	....	2	11·5295	....	....	....

Weighted mean .... +68·45
V_a .... −19·63
V_d .... − ·20
Curvature .... − ·28

Radial velocity .... + 48·3

α CORONÆ BOREALIS, 1827.

1908. Aug. 25.
G. M. T. 13^h

Observed by } J. B. Cannon.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·6765	....	....	....	1	45·2167	45·2857	·0470	+49·06
1	53·9543	54·0213	·0515	+[59·28]	¼	27·4307	27·4547	·0421	+36·54
2	53·0434	....	....	....	2	27·2226	....	....	....
2	45·2046	....	....	....					

Weighted mean .... +46·56
V_a .... −19·51
V_d .... − ·17
Curvature .... − ·28

Radial velocity .... + 26·6

α CORONÆ BOREALIS, 1836.

1908. Aug. 27.
G. M. T. 14h 34m

Observed by / Measured by } J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0226	....	....	....	2	45·2911	....	....	....
½	72·8899	72·8770	·0122	+17·70	1	45·2916	45·2741	·0354	+36·95
1	72·4579	....	....	....	½	27·4900	27·4623	·0497	+43·13
2	54·7549	....	....	....	2	27·2740	....	....	....
1	53·9889	53·9763	·0065	+[7·48]	½	11·9036	11·8701	·0187	+14·00
2	53·1241	....	....	....	2	11·5409	....	....	....

Weighted mean........................		+29·74
V_a	−19·21	
V_d	− ·28	
Curvature...........	− ·28	
Radial velocity		+ 10·0

α CORONÆ BOREALIS, 1841.

1908. Aug. 28.
G. M. T. 13h

Observed by / Measured by } J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0259	....	....	....	½	27·5064	27·4684	·0558	+48·43
½	72·8870	72·8701	·0053	+ 7·69	2	27·2849	....	....	....
1	72·4641	....	....	....	1	11·9382	11·8832	·0318	+23.82
2	45·2921	....	....	....	2	11·5626	....	....	....
1	45·2848	45·2663	·0276	+28·81					

Weighted mean........................		+24 94
V_a	−19·03	
V_d	− ·19	
Curvature...........	− ·28	
Radial velocity		+ 5·4

α CORONÆ BOREALIS, 1842.

1908. Aug. 28.
G. M. T. 13h 14m

Observed by / Measured by } J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0092	....	....	....	2	45·2878	....	....	....
¼	72·8733	72·8738	·0090	+13·06	1	45·2838	45·2696	·0309	+32·26
1	72·4448	....	....	....	⅓	27·4705	27·4412	·0286	+24·82
2	54·7462	....	....	....	2	27·2762	....	....	....
¼	54·0117	54·0051	·0353	+[39·63]	¼	11·9601	11·9223	·0709	+53·10
2	53·1214	....	....	....	2	11·5452	....	....	....

Weighted mean	....	+30·60
V_a	−19·03	
V_d	− ·20	
Curvature	− ·28	
Radial velocity	....	+ 11·1

α CORONÆ BOREALIS, 1852.

1908. Aug. 31.
G. M. T. 13h 17m

Observed by W. E. HARPER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0311	....	....	....	1	27·4462	27·4423	·0297	+25·78
½	72·8743	72·8536	·0112	−12·89	2	27·2515	....	....	....
1	72·4637	....	....	....	¼	11·8686	11·8702	·0188	+14·08
2	45·2785	....	....	....	2	11·5056	....	....	....
1½	45·2366	45·2317	·0070	− 7·31					

Weighted mean	+ 3·66	
V_a		−18·53
V_d		− ·22
Curvature		− ·28
Radial velocity		− 15·4

α CORONÆ BOREALIS, 1852*.

1908. Aug. 31.
G. M. T. $13^h 17^m$

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0047	....	....	....	½	27·4278	27·4397	·0271	+23·52
½	72·8550	72·8598	·0050	− 7·25	2	27·2347	....	....	....
1	72·4409	....	....	....	½	11·8520	11·8750	·0236	+17·68
2	45·2570	....	....	....	2	11·4840	....	....	....
1	45·2188	45·2354	·0033	− 3·45					

Weighted mean	+ 4·05
V_a	−18·53
V_d	− ·22
Curvature	− 28
Radial velocity	− 15·0

* Check Measurement

α CORONÆ BOREALIS, 1861.

1908. Sept 3.
G. M. T. $12^h 50^m$

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0328	....	....	....	½	27·4429	27·4029	·0097	− 8·42
½	72·8769	72·8535	·0113	−16·40	2	27·2866	....	....	....
1	72·4697	....	....	....	1	11·8911	11·8395	·0119	− 8·91
2	45·2913	....	....	....	2	11·5592	....	....	....
1	45·2442	45·2265	·0122	−12·74					

Weighted mean	−11·35
V_a	−18·03
V_d	− ·21
Curvature	− ·28
Radial velocity	− 29·9

α CORONÆ BOREALIS, 1865.

1908. Sept. 4. Observed by T. H. Parker.
G. M. T. 13h 27m Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0201	......	......	......	2	45·2962	......	......	......
½	72·8801	72·8693	·0045	+ 6·53	1	45·2687	45·2461	·0074	+ 7·73
1	72·4571	......	......	......	¼	27·4456	27·3976	·0150	− 10·02
2	54·7639	......	......	......	2	27·2919	......	......	......
1	53·9634	53·9411	·0287	− [33·03]	¼	11·9038	11·8461	·0053	− 3·97
2	53·1346	......	......	......	2	11·5651	......	......	......

Weighted mean................ + 3·75
V_a.......................... − 17·87
V_d.......................... − ·27
Curvature...................... − ·28

Radial velocity........................ − 14·7

α CORONÆ BOREALIS, 1882.

1908. Sept. 14. Observed by J. S. Plaskett.
G. M. T. 12h 51m Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0319	......	......	......	2	45·3247	......	......	......
½	72·9093	72·8867	·0219	+ 31·78	1	45·3219	45·2708	·0321	+ 33·51
1	72·4692	......	......	......	½	27·5253	27·4463	·0337	+ 29·25
2	54·7787	......	......	......	2	27·3257	......	......	......
¼	54·0006	53·9646	·0052	− [5·99]	1½	12·0035	11·8975	·0451	+ 33·78
2	53·1472	......	......	......	2	11·6135	......	......	......

Weighted mean.......................... + 32·77
V_a.................. − 15·95
V_d.................. − ·23
Curvature.............. − ·28

Radial velocity........................ + 16·3

α CORONÆ BOREALIS, 1883.

1908. Sept. 14.
G. M. T. $13^h 07^m$

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7551	......	......	......	2	27·2799	......	......	......
½	54·0166	54·0060	·0362	+[40·57]	¼	15·5465	15·4985	·0252	+19·50
2	53·1201	......	......	......	2	15·4467	......	......	......
2	45·2864	......	......	......	1	11·9188	11·8737	·0223	+16·70
1	45·2824	45·2696	·0309	+32·26	2	11·5523	......	......	......
¼	27·4653	27·4323	·0197	+17·10					

Weighted mean........................		+22·85
V_a	−15·95	
V_d	− ·23	
Curvature...........	− ·28	
Radial velocity........................		+ 6·4

α CORONÆ BOREALIS, 1894.

1908. Sept. 19.
G. M. T. $12^h 02^m$

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0180	......	......	......	2	45·3163	......	......	......
½	72·8619	72·8515	·0133	−19·30	½	45·2773	45.2346	·0041	− 4·28
2	72·4620	......	......	......	½	27·4673	27·4000	·0126	−10·94
2	54·7725	......	......	......	2	27·3142	......	......	......
¼	53·9865	53·9545	·0153	−[17·51]	½	11·9190	11·8336	·0178	−13·33
2	53·1454	......	......	......	2	11·5926	......	......	......

Weighted mean	−11·96
V_a	−14·58
V_d	− ·22
Curvature....................	− ·28
Radial velocity....................	− 27·0

α CORONÆ BOREALIS, 1895.

1908. Sept. 19. G. M. T. 12ʰ 17ᵐ — Observed by J. S. Plaskett. Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0038	....	....	....	2	45·2814	....	....	....
½	72·8573	72·8633	·0015	−2·18	1	45·2429	45·2351	·0036	−3·76
2	72·4388	....	....	....	¼	27·4293	27·4118	·0008	−0·69
2	54·7388	....	....	....	2	27·2643	....	....	....
½	53·9565	54·9580	·0118	−[13·58]	1½	11·8895	11 8595	·0081	+6·07
2	53·1120	....	....	....	2	11·5373	....	....	....

Weighted mean	+ 1·26
V_a	−14·58
V_d	− ·22
Curvature	− ·28
Radial velocity	−13·8

α CORONÆ BOREALIS, 1896.

1908. Sept. 19. G. M. T. 12ʰ 30ᵐ — Observed by J. S. Plaskett. Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7526	....	....	....	1½	45·2619	45·2371	·0016	−1·67
½	53·9992	53·9889	·0191	+[21·98]	1	27·4389	27·3969	·0157	−13·63
2	53·1219	....	....	....	2	27·2889	....	....	....
2	45·2984	....	....	....					

Weighted mean	− 6·26
V_a	−14·58
V_d	− ·22
Curvature	− ·28
Radial velocity	−21·3

α CORONÆ BOREALIS, 1897.

1908. Sept. 19. G. M. T. 12ʰ 42ᵐ — Observed by J. S. Plaskett. Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0197	....	....	....	2	45·3094	....	....	....
½	72·8669	11·8573	·0075	−10·88	1½	45·2797	45·2439	·0052	+5·43
2	72·4537	....	....	....	1	27·4750	27·4097	·0029	−2·52
2	54·7572	....	....	....	2	27·3122	....	....	....
½	53·9924	53·9731	·0033	+[3·80]	1	11·9309	11·8492	·0022	−1·65
2	53·1352	....	....	....	2	11·5892	....	....	....

Weighted mean	− 0·37
V_a	−14·58
V_d	− ·22
Curvature	− ·28
Radial velocity	−15·5

α CORONÆ BOREALIS, 1949.

1908. Nov. 1.
G. M. T. $10^h\ 41^m$

Observed by / Measured by } J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9672	....	....	....	1	45·3092	....	....	....
¼	72·8800	72·9220	·0572	+82·99	1	45·2928	45·2928	0185	+19·31
1	54·7508	....	....	....					

Weighted mean		+39·88
V_a	− ·38	
V_d	− ·27	
Curvature	− ·28	
Radial velocity		+38·9

α CORONÆ BOREALIS, 1950.

1908. Nov. 1.
G. M. T. $10^h\ 58^m$

Observed by / Measured by } J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	48·7674	....	....	....	2	27·3286	....	....	....
1	45·3178	45·3118	·0631	+65·87	¼	12·0368	11.9236	·0722	+54·07
¼	27·5393	27·4850	·0724	+62·84	1	11·6326	....	....	....

Weighted mean		+63·40
V_a	− ·38	
V_d	− ·27	
Curvature	− ·28	
Radial velocity		+62·5

α CORONÆ BOREALIS, 1951.

1908. Nov. 1.
G. M. T. $11^h\ 14^m$

Observed by / Measured by } J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	45·3028	....	....	....	1	45·3170	45·2878	·0491	+51·26

Velocity		+51·26
V_a	− ·38	
V_d	− ·27	
Curvature	− ·28	
Radial velocity		+50·3

OBSERVING RECORD AND DETAILED MEASURES OF δ AQUILÆ.

P.—PLASKETT.
H.—HARPER.
C.—CANNON.
P^1.—PARKER.
T.—TRIBBLE.

RECORD OF SPECTROGRAMS.

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure. G. M. T.	Duration.	Hour Angle at end.	Temperature. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width.	Seeing.	Observer.
				1906.	h. m.	m.	h. m.	Fahrenheit.		Centigrade				
δ Aquilæ.	368	..	Seed 27.	Aug. 6	17 35	85	2 55W.	71·0	69·4	27·7	28·0	·001	Good...	H
" ..	377	..	" R.	" 15	15 40	70	1 07W.	68·2	66·0	25·6	25·6	·001	" ...	H
" ..	382	..	" ..	" 24	15 45	90	2 15W.	64·0	62·1	22·8	22·9	·001	Fair....	H
" ..	390	..	" ..	Sept. 10	15 30	60	2 50W.	69·0	67·0	26·7	26·7	·001	Good...	H
" ..	399	..	" ..	" 27	14 45	60	3 15W.	60·0	59·6	21·8	21·8	·001	" ...	H
" ..	413	..	" 27	Oct. 23	13 45	90	4 10W.	50·3	46·2	15·1	15·3	·001	Dancing	H
				1907.				Centi grade						
" ..	803	IL	" ..	May 31	19 04	25	35E.	12·6	12·6	18·7	18·7	·001	Good...	P
" ..	818	"	" ..	June 10	19 13	20	15W.	12·4	12·1	17·8	17·8	·0012	" ...	P
" ..	904	"	" ..	July 2	18 12	24	40W.	13·5	14·0	17·0	17·0	·0014	" ...	H
" ..	923	"	" ..	" 8	18 02	25	55W.	20·2	20·1	22·3	22·2	·0012	Poor to fair...	P
" ..	930	"	" ..	" 9	16 33	30	30E.	21·5	20·9	25·0	25·0	·0012	Good...	H
" ..	938	"	" ..	" 10	16 30	30	28E.	22·6	22·4	24·5	24·5	·0012	Fair to poor..	P
" ..	966	"	" ..	" 25	16 30	60	48W.	21·5	21·5	28·0	27·8	·0014	Poor....	H
" ..	980	"	" ..	Aug. 3	14 40	30	45E.	19·5	19·5	24·0	24·1	·0012	......	P
" ..	982	"	" ..	" 5	16 36	28	1 10W.	17·6	17·6	21·0	21·0	·0012	Fair to poor..	P
" ..	1034	"	" ..	Sept. 6	15 44	41	2 35W.	18·3	18·0	21·0	20·5	·0012	Fair....	T
" ..	1049a 1049b	" "	" "	" 18	13 56	47	1 42W.	14·0	12·5	17·1	17·1	·0014	"	T
				1908.										
" ..	1543	"	" ..	May 18	20 06	30	0 00	15·5	15·0	23·4	23·4	·0016	Hazy...	H
" ..	1550	"	" ..	" 22	20 34	42	39W.	19·0	19·0	25·0	25·0	·0017	Fair....	H
" ..	1575	"	" ..	June 3	20 01	40	45W.	13·0	12·5	18·3	18·3	·0015	"	H
" ..	1584	"	" ..	" 5	20 35	40	1 30W.	14·0	14·3	24·4	24·4	·0016	Notgood	P^1
" ..	1633	"	" ..	" 24	18 31	37	40W.	19·0	19·0	27·5	27·5	·0015	Good...	H
" ..	1642	"	" ..	" 26	18 52	55	1 20W.	17·6	17·5	30·2	30·0	·0016	" ...	P^1
" ..	1650	"	" .	" 27	18 09	35	30W.	19·5	19·1	23·6	23·4	·0014	. ...	P
" ..	1660	"	" ..	July 3	18 35	50	25W.	20·5	20·1	25·1	25·1	·0016	Fair....	HP^1
" ..	1678	"	" ..	" 8	18 10	40	1 15W.	17·0	17·5	21·6	21·6	·0015	Good...	C-H
" ..	1690	"	" ..	" 10	18 35	45	1 55W.	21·1	20·5	27·5	28·0	0016	" ..	P^1
" ..	1695	"	" ..	" 11	18 27	35	1 45W.	26·0	25·4	29·8	29·7	·0015	Fair....	P
" ..	1703	"	" ..	" 13	18 52	45	2 25W.	18·2	18·0	23·0	23·0	·0015	Good...	P^1
" ..	1753	"	" ..	" 31	16 41	32	1 10W.	19·5	19·5	26·0	25·9	·0015	" ...	P^1
" .	1754	"	" .	" 31	17 17	34	1 48W.	19·5	19·0	25·9	25·6	·0015	" ...	H
" ..	1768	"	" ..	Aug. 5	18 05	40	2 55W.	20·8	20·5	26·7	26·5	·0015	....	P-C
" ..	1783	"	" ..	" 15	17 38	30	3 05W.	18·0	17·6	22·5	22·4	·0015	Fair....	P
" ..	1837	"	" ..	" 27	15 03	35	1 20W.	18·0	17·0	23·2	23·0	·0015	Good...	C

δ AQUILÆ 368.

1906. Aug. 6.
G. M. T. 17ʰ 35ᵐ

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
3	S 68·3790	4528·798				
3	65·3512	4494·626		·738		
1	64·1176	4480·972	·000	·400	·400	−26·76
2	63·6677	4476·194		·185		
2	62·7948	4466·791		·727		
½	61·5939	4454·023	·973	·552	·579	39·63
3	S 56·8011	4404·927				
2	54·6445	4383·756		·720		
3	50·0285	4340·237	·184	·634	·450	31·05
3	48·4614	4325·992		·939		
3	S 46·4500	4308·081				
1	45·4172	4299·044		·074		
3	44·8605	4294·217		·301		
2	44·3248	4289·601	·642	·032	·390	−27·22

Weighted mean.................... −31·16
V_a.............................. −10·00
V_d.............................. − ·16
Curvature.......................... − ·50

Radial velocity.................... −41·8

δ AQUILÆ 377.

1906. Aug. 15.
G. M. T. 15ʰ 40ᵐ

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
2	S 70·1969	4549·642				
2	70·1460	4549·039	·039	·642	·603	−39·73
½	68·8403	4533·723	·753	·168	·415	27·43
3	68·4118	4528·757		·798		
2	65·4082	4494·722		·738		
2	64·1638	4481·013	·953	·400	·447	29·90
2	63·7291	4476·277		·185		
½	63·0706	4469·152	·062	·545	·485	32·36
2	62·8551	4466·835		·727		
½	58·1412	4417·700	·670	·038	·368	24·95
3	S 56·8682	4404·927				
2	54·6973	4383·606		·720		
3	50·0813	4340·115	·184	·634	·450	31·05
3	48·5181	4325·926		·939		
3	S 46·5100	4308·081				
2	44·9317	4294·348		·301		
1	44·9073	4294·138		·301		
1	44·3830	4289·632	·590	·032	·442	−30·85

Weighted mean.................... −30·89
V_a.............................. −13·62
V_d.............................. − ·19
Curvature.......................... − ·50

Radial velocity.................... −45·2

δ AQUILÆ 382.

1906. Aug. 24.
G. M. T. $15^h\ 45^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
2	70·1122	4549·520		·642		
1	70·1029	4549·410	·530	·905	·375	−24·71
3	S 68·3400	4528·798				
1	67·7987	4522·566	·558	·855	·297	19·69
1	65·9371	4501·472		·505		
2	65·3329	4494·735		·738		
1	64·0791	4480·926	·930	·400	·470	31·44
2	63·6431	4476·176		·185		
2	62·7647	4466·688		·727		
½	59·7630	4435·058	·078	·450	·372	25·14
2	S 56·7937	4404·927				
1	56·3165	4400·188	·188	·738	·550	37·45
½	55·7715	4394·808	·804	·286	·482	32·87
2	54·6357	4383·715		·720		
½	53·7124	4374·809	·821	·103	·282	19·31
2	50·0145	4340·120	·134	634	·500	34·50
2	48·4534	4325·930		·939		
1	47·9225	4321·164				
2	S 46·4482	4308·081	·164			
2	44·8650	4294·280		·301		
½	44·8327	4294·002	·018	·301	·283	19·78
½	44·3189	4289·578	·596	032	.436	−30·52

Weighted mean	−27·54
V_a	−16·98
V_d	− .12
Curvature	− ·50
Radial velocity	−45·1

δ AQUILÆ 390.

1906. Sept. 10.
G. M. T. $15^h\ 30^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
1	65·2901	4494·811		·738		
1	64·0719	4481·396	·360	·400	·040	− 2·67
1	63·6037	4476·296		·185		
2	54·5817	4383·730		·720		
½	49·9026	4339·632	·620	·640	·020	− 1·38
3	48·3953	4325·945		·939		

Weighted mean	− 2·00
V_a	−22·26
V_d	− ·19
Curvature	− ·28
Radial velocity	−25·0

δ AQUILÆ 399.

1906. Sept. 27.
G. M. T. 14^h 45^m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
3	70·1090	4549·618		·642		
1	68·7305	4533·425	·432	·419	·013	+ 0·85
	S 68·3316	4528·798				
3	65·3312	4494·755		·738		
2	64·7742	4488·581	·573	·495	·078	+ 5·21
1	64·1215	4481·405	·405	·400	·005	+ 0·33
3	63·6427	4476·178		·185		
3	62·7675	4466·710		·727		
1	62·3372	4462·093	·109	·165	·056	− 3·75
2	62·0765	4459·309		·301		
1	61·1665	4449·662	·676	·785	·109	− 7·33
1	58·0743	4417·705	·695	·884	·189	− 12·81
	S 56·8037	4404·927				
1	55·8229	4395·202	·210	·201	·009	+ 0·61
1	54·6149	4383·677		·720		
1	53·6987	4370·905		·144		
2	50·0504	4340·559	·564	·634	·070	− 4·83
2	48·4750	4325·930		·939		
	S 46·4725	4308·081				
2	44·8957	4294·319		·301		
2	44·3930	4289·984	·964	·032	·068	− 4·75
½	42·1961	4271·329	·305	·325	·020	− 1·40

Weighted mean	− 2·68
V_a	− 25·74
V_d	− ·22
Curvature	− ·50
Radial velocity	− 29·0

δ AQUILÆ 413.

1906. Oct. 23.
G. M. T. 13^h 45^m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
1	70·1315	4549·642	·642	·642	·000	0·00
1	S 70·1315	4549·642				
2	68·3595	4528·840		·798		
1	65·3580	4494·715		·738		
2	64·1318	4481·159	·190	·400	·210	− 14·04
1	63·6731	4476·145		·185		
3	S 56·8482	4404·927				
2	54·6954	4383·707		·720		
1	53·7352	4374·423	·439	·628	·189	− 12·94
1	50·1309	4340·528	·540	·640	·100	− 6·90
3	48·5299	4325·938		·939		
3	S 46·5280	4308·081				
½	46·4975	4307·813	·813	·023	·210	− 14·61

Weighted mean	− 10·04
V_a	− 26·88
V_d	− ·25
Curvature	− ·50
Radial velocity	− 37·7

δ AQUILÆ 803.

1907. May 31.
G. M. T. $19^h\ 04^m$

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8154	....	....	....	½	45·9607	·9592	·0280	29·45
1	57·7707	·7847	·0421	−50·68	2	45·2762	....	....	....
2	54·7232	....	....	....	1	45·1958	·1938	·0449	46·87
1	53·9416	·9516	·0182	20·94	2	43·5392	....	....	....
2	53·1061	....	....	....	2	37·9741	....	....	....
2	48·7682	....	....	....	1	37·2332	·2192	·0696	66·73
1	48·6938	6958	·0682	75·38	1	27·3902	·3422	·0704	−61·10
1	47·4378	·4383	·0321	34·34	2	27·2954	....	....	....

Weighted mean	....	−47·92
V_a	+18·24	
V_d	+ ·07	
Curvature	....	− ·28
Radial velocity		− 29·9

δ AQUILÆ 818.

1907. June 10.
G. M. T. $19^h\ 13^m$

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8253	....	....	....	1	45·9704	·9304	·0568	59·75
1	57·7820	·7780	·0488	−58·75	2	45·3146	....	....	....
2	54·7558	....	....	....	1	45·2333	·1923	·0464	48·44
2	48·8030	....	....	....	2	43·5841	....	....	....
1	48·7360	·7034	·0606	65·75	1	27·4760	·3520	·0606	−52·60
1	47·4522	·4162	·0542	57·99	2	27·3713	....	....	....

Weighted mean	....	−57·21
V_a	+14·68	
V_d	0·00	
Curvature	....	− ·28
Radial velocity		− 42·8

δ AQUILÆ 904.

1907. July 2.
G. M. T. 18h 12m

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
3	72·9426	4864·756	....	·943	....	....
2	72·7683	4860·608	·837	·527	·690	−42·57
2	72·3857	4851·637	....	·686	....	....
1	57·8055	4550·333	....	·642	....	....
1½	57·7888	4550·031	·332	·642	·310	20·48
1½	54·0165	4483·099	....	·413	....	....
1½	53·9383	4481·751	·050	·400	·350	23·41
2	52·2394	4452·897	....	·180	....	....
3	48·7760	4396·316	....	·382	....	....
1	48·7398	4395·740	·820	·286	·466	31·78
1½	47·4590	4375·754	·774	·107	·333	22·88
2	45·2878	4342·183	....	·162	....	....
1	45·2205	4341·168	·108	·634	·526	−36·29
....	42·1262	4295·425	....	·290	....	....

Weighted mean		− 24·85
V_a	+ 5·63	
V_d		− ·04
Curvature		− ·28
Radial velocity		− 19·5

δ AQUILÆ 923.

1907. July 8.
G. M. T. 18h 02m

Observed by J. S. PLASKETT.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7604	....	....	....	2	45·3152	....	....	....
1	53·9708	·9458	·0240	−27·62	1	45·2452	·2042	·0345	36·01
2	53·1390	....	....	....	2	38·0093	....	....	....
½	52·4227	·3947	·0201	22·73	1	37·3176	·2651	·0237	22·72
2	52 2767	....	....	....	2	35·4883	....	....	....
2	48·8029	....	....	....	1	27·4678	·3798	·0328	—28·47
1	45.9830	·9440	·0400	42·08	2	27·3349	....	....	....

Weighted mean		− 30·63
V_a	+ 2·96	
V_d		— ·07
Curvature		− ·28
Radial velocity		− 28·0

δ AQUILÆ 930.

1907. July 9.
G. M. T. $16^h\ 33^m$

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8333	....	....	....	1	48·7412	·7360	·0280	30·40
1	57·8169	·8129	·0139	−16·73	1	47·4795	·4670	·0034	03·63
2	54·7487	....	....	....	2	45·2875	....	....	....
1	53·9750	·9680	·0018	02·07	1	45·2244	·2104	·0283	29·54
2	53·1198	....	....	....	2	37·9870	....	....	....
2	48·7812	....	....	....	1	37·2898	·2620	·0268	−25·70

Weighted mean..................		−17·98
V_a............	+ 2·54	
V_d............	+ ·08	
Curvature		− ·28
Radial velocity.................		− 15·6

δ AQUILÆ 938.

1907. July 10.
G. M. T. $11^h\ 30^m$

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8376	....	....	....	2	42·1585	....	....	....
½	58·6448	·6188	·0209	+25·41	1	41·8098	·7538	·0778	−78·26
2	57·8525	....	....	....	2	38·0165	....	....	....
1	57·8362	·8107	·0161	−19·38	½	36·5035	·4365	·0597	−56·77
2	54·7745	....	....	....	2	35·4998	....	....	....
2	48·8114	....	....	....	2	30·9556	....	....	....
½	47·4796	·4351	·0353	−38·47	½	30·8842	·8082	·0674	−60·52
2	45·3240	....	....	....	1	27·4150	·3270	·0856	−74·30
1	45·2632	·2128	·0255	−26·62	2	27·3430	....	....	....
1	44·2754	·2239	·0148	−15·28	2	22·6567	....	....	....
2	43·5880	....	....	....	½	22·6152	·5153	·0791	−65·49

Weighted mean		−20·40
V_a..........	+ 2·18	
V_d............	·00	
Curvature..............		− ·28
Radial velocity..................		−18·5

δ AQUILÆ 966.

1907. July 25.
G. M. T. $16^h\ 30^m$

Observed by W. E. HARPER.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·7993				2	45·2612			
1	57·7957	·8227	·0041	−04·93	½	45·2242	·2252	·0135	14·09
2	54·7201				2	43·5371			
1	53·9306	·9601	·0097	11·16	½	27·4259	·3856	·0267	−23·17
2	53·0970								

Weighted mean	−11·57
V_a	− 4·63
V_d	− ·02
Curvature	− ·28
Radial velocity	−16·5

δ AQUILÆ 980.

1907. Aug. 3.
G. M. T. $14^h\ 40^m$

Observed by J. S. PLASKETT.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8416				½	46·0142	·3765	·0100	−10·52
½	59·0484	·0185	·0222	−27·10	2	45·3113			
2	57·8562				1	45·2599	·2222	·0168	17·55
1	57·8448	·8178	·0090	10·83	½	44·2852	·2468	·0130	13·42
2	54·7701				2	43·5768			
1	53·9962	·9672	·0026	−02·99	1	41·8349	·7965	·0387	38·93
2	48·8045				½	27·4712	·3986	·0124	−10·76
1	47·5163	·4803	·0099	−10·59					

Weighted mean	−16·87
V_a	− 8·53
V_d	− ·04
Curvature	− ·28
Radial velocity	−25·7

δ AQUILÆ 982.

1907. Aug. 5.
G. M. T. $16^h\ 36^m$

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8462	....	....	....	1	45·2591	·2231	.0156	−16·28
½	57·8389	·8221	·0047	−05·65	2	44·2644	·2274	·0318	32·84
1	56·9690	·9515	·0140	16·68	2	43·5747	....	....	....
1	56·6945	....	....	....	2	42·1445	....	....	....
2	48·8009	....	....	....	1	41·8297	·7872	·0441	44·36
1	47·5019	·4698	·0006	−00·64	2	30·9363	....	....	....
1½	46·0152	·9812	·0060	+06·31	1	30·8976	·8317	·0439	−39·42
2	45·3083	....	....	....					

Weighted mean................................	−19·60
V_a................................	− 9·42
V_d................................	− ·09
Curvature................................	− ·28
Radial velocity................................	−29·4

δ AQUILÆ 1034.

1907. Sept. 6.
G. M. T. $15^h\ 44^m$

Observed by J. N. Tribble.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8664	....	....	....	2	43·5443	....	....	....
1½	57·8788	·8313	·0045	+05·42	1	43·4850	....	....	....
1	57·8768	....	....	....	2	37·9634	....	....	....
2	54·7733	....	....	....	1	37·2692	·2682	·0196	−18·79
1	54·0167	·9887	·0189	+21·75	2	35·4242	....	....	....
2	48·7842	....	....	....	1½	35·1650	·1650	·0160	+15·00
1	48·7878	·7736	·0096	+10·42	2	30·8659	....	....	....
2	45·2868	....	....	....	1	30·8385	·8425	·0331	−29·72
1	45·2454	·2322	·0065	−06·78	1	27·3874	·3944	·0182	−15·79

Weighted mean........................	− 3·84
V_a........................	−21·09
V_d........................	− ·16
Curvature........................	− ·28
Radial velocity........................	−25·4

δ AQUILÆ 1049 (*a*).

1907. Sept. 18.
G. M. T. $8^h\ 56^m$

Observed by J. N. Tribble.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8694	....	....	....	2	41·3069	....	....	....
1	57·8779	·8279	·0011	+01·32	2	37·9839	....	....	....
2	57·8775	....	....	....	1	37·2896	·2646	·0242	−23·20
1	57·6237	·5757	·0189	+22·68	1	30·8967	....	....	....
½	55·1806	·1351	·0099	+11·54	1	30·8663	·8403	·0353	−30·69
1	54·0309	·9859	·0161	+18·53	1	27·4422	·4182	·0056	+04·86
2	53·1554	....	....	....	2	27·2681	....	....	....
2	45·3054	....	....	....	2	24·8642	....	....	....
1½	45·2848	·2508	·0121	+12·63	1	24·8329	·8136	·0316	−26·73
2	43·5724	....	....	....	2	22·5796	....	....	....
1	41·8318	·8078	·0238	−23·94	½	22·5650	·5412	·0146	−12·08

Weighted mean	− 3·66
V_a	−24·00
V_d	− ·09
Curvature	− ·28
Radial velocity	−28·0

δ AQUILÆ 1049 (*b*).

1907. Sept. 18.
G. M. T. $8^h\ 56^m$

Observed by J. N. Tribble.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8589	....	....	....	1	42·5064	·4794	·0314	−31·80
1	57·8824	·8409	·0141	+16·97	2	42·1333	....	....	....
2	57·8709	....	....	....	½	41·8333	·8073	·0243	−24·44
1	57·6069	·5659	·0091	+10·92	2	41·3082	....	....	....
½	55·1507	·1142	·0110	−12·82	2	37·9828	....	....	....
¼	54·0154	·9804	·0106	+12·20	½	37·3204	·2984	·0096	+09·20
2	45·3012	....	....	....	2	24·8630	....	....	....
1	45·2860	·2575	·0188	+19·62	½	24·8351	·8173	·0279	−23·63
2	43·5663	....	....	....					

Weighted mean	− 1·58
V_a	−24·00
V_d	− ·09
Curvature	− ·28
Radial velocity	−25·9

δ AQUILÆ 1543.

1908. May 18.
G. M. T. 20h 06m

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8118	....	....	....	2	45·2857	....	....	....
1	59·6115	·6090	·0655	−80·56	1	45·1924	·1819	·0568	59·29
1½	57·7867	·7867	·0401	48·28	1	44·2082	·1967	·0625	64·56
½	56·9378	·9388	·0267	31·82	2	43·5501	....	....	....
2	56·6665	....	....	....	1	39·9986	·9811	·0352	34·35
½	55·0793	·0793	·0459	53·51	½	37·2334	·2134	·0754	72·30
1	53·9367	·9352	·0346	39·82	2	37·9775	....	....	....
2	53·1154	....	....	....	2	30·8437	·8107	·0649	58·27
1½	52·3898	·3868	·0280	31·66	½	27·3944	·3544	·0582	−50·50
1	51·6895	·6860	·0715	80·22	2	27·2870	....	....	....
2	48·7751	....	....	....					

Weighted mean........................		−43·49
V_a	+21·88	
V_d	+ ·01	
Curvature		− ·28
Radial velocity........................		− 21·9

δ AQUILÆ 1550.

1908. May 22.
G. M. T. 20h 34m

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8566	....	....	....	2	43·5800	....	....	....
1	53·9680	·9260	·0438	−50·41	1	43·5040	·4590	·0742	75·90
2	53·1527	....	....	....	½	42·4743	·4268	·0840	85·09
½	52·4092	·3682	·0466	52·70	2	37·3817	....	....	....
1	51·7194	·6799	·0796	89·31	1	37·3052	·2552	·0336	32·22
2	50·0548	....	....	....	½	30·8480	·7940	·0816	73·26
2	45·3223	....	....	....	1	27·4542	·3942	·0184	−15·97
1	45·2179	·1724	·0663	70·54	2	27·3097	....	....	....

Weighted mean........................		−60·57
V_a	+20·77	
V_d	·00	
Curvature		− ·28
Radial velocity........................		− 40·1

δ AQUILÆ 1575.

1908. June 3.
G. M. T. $20^h\ 01^m$

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8247	......	......	......	2	50·0325	......	......	......
1	58·9976	·9581	·0581	−71·11	1	48·7496	·7236	·0404	43·95
2	57·7944	·7574	·0473	57·04	2	45·3116	......	......	......
2	57·8347	......	......	......	½	45·2466	·2206	·0281	29·12
1	56·9377	·9027	·0426	50·86	1	44·2465	·2215	·0508	52·62
2	56·6840	......	......	......	2	43·9300	·9060	·0345	35·60
½	55·1020	·0700	·0391	45·70	2	41·3243	......	......	......
1	53·9550	·9250	·0316	36·22	1½	37·3066	·2946	·0301	−29·24

Weighted mean.................... −45·35
V_a .... +16·94
V_d.......................... − ·04
Curvature.................... − ·28

Radial velocity........................ − 28·7

δ AQUILÆ 1575.

1908. June 3.
G. M. T. $20^h\ 01^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Vel city.
2	57·7480	......	......	......	2	45·2208	......	......	......
2	57·7020	·7562	·0475	−57·28	1	45·1452	·2080	·0307	32·14
1	56·8536	·9100	·0353	42·15	1	44·1533	·2163	·0560	58·02
2	56·5944	......	......	......	½	42·3660	·4300	·0406	41·29
1	55·0194	·0796	·0295	34·48	2	42·0584	......	......	......
2	54·6613	......	......	......	1	41·2210	·2860	·0337	33·83
1½	53·8672	·9287	·0279	32·20	2	39·6969	......	......	......
2	53·0411	......	......	......	1	38·6841	·7516	·0318	31·07
1	52·2948	·3573	·0479	54·27	1	37·2157	·2842	·0408	39·25
2	52·1800	......	......	......	2	30·8595	......	......	......
2	48·7090	......	......	......	1½	30·7894	·8774	·0585	52·77
½	48·6414	·7039	·0601	65·39	2	22·5580	......	......	......
1	45·8895	·9522	·0430	45·36	1	22·4961	·5909	·0619	−51·56

Weighted mean......................... −44·84
V_a .... +16.94
V_d........................... − .04
Curvature .... − ·28

Radial velocity.......................... −28·2

δ AQUILÆ 1584.

1908. June 5.
G. M. T. 20h 35m

Observed by } T. H. Parker.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	59·8185	....	....	....	1	45·1990	·1958	·0429	44·78
1	59·6231	·6140	·0605	−74·41	2	37·9604	....	....	....
1	57·7645	·7645	·0623	75·00	½	37·2349	·2404	·0484	46·41
2	56·6595	....	....	....	2	36·1205	·4255	·0707	67·23
1	53·9346	·9376	·0322	37·06	1	35·1146	·1186	·0304	28·51
2	53·1106	....	....	....	2	35·4265	....	....	....
1	52·3912	·3908	·0240	27·14	1½	30·8236	·8176	·0580	52·08
½	51·7052	·7022	·0553	62·04	1	27·3774	·3664	·0462	40·10
1½	50·9223	·9183	·0348	38·69	1	27·2576	....	....	....
1	50·0435	....	....	....	½	18·8335	....	·0441	−35·23
1	48·7062	·7012	·0618	67·10	1	18.8776	....	....	....
2	45·2770	....	....	....					

Weighted mean............................		−51·40
V_a........................	+16·22	
V_d....................................		− ·09
Curvature..................................		− ·28
Radial velocity..............................		−35·5

δ AQUILÆ 1633.

1908. June 24.
G. M. T. 18h 31m

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8112	....	....	....	1	45.2090	·2005	·0382	39·88
1	57·7871	·7941	·0327	−39·37	2	44·2642	....	....	....
2	57·8218	....	....	....	2	41·2960	....	....	....
½	55·4842	·4887	·0353	41·33	1	40·4965	·4875	·0385	38·09
2	54·7384	....	....	....	2	35·4349	....	....	....
1	53·9350	·9365	·0333	38·32	1	35·3907	·3857	·0419	39·42
2	53·1133	....	....	....	½	27·3962	·3792	·0334	−28·99
2	45·2822	....	....	....	2	27·2636	....	....	....

Weighted mean............................		−37·91
V_a........................	+ 8·74	
V_d........................	·00	
Curvature..................................		− ·28
Radial velocity..............................		−29·5

δ AQUILÆ 1642.

1908. June 26.
G. M. T. 18h 52m

Observed by }
Measured by } T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8137	....	....	....	2	43·5225	....	....	....
1	59·4942	....	....	....	½	42·6036	·6166	·0230	23·34
½	58·9788	·9748	·0659	− 80·46	2	42·1050	....	....	....
1	58·5962	·5922	·0057	6·93	½	41·7834	·7807	·0352	35·41
2	57·8290	....	....	....	1	40·4726	·4755	·0413	40·96
1	57·7667	·7637	·0631	75·97	2	39·7305	....	....	....
3	56·6748	....	....	....	2	37·9465	....	....	....
1	53·9205	·9215	·0483	55·59	1½	37·6986	·7096	·0451	43·47
3	53·1059	....	....	....	½	37·2113	·2218	·0670	64·25
1	51·6633	·6683	·0892	100·08	2	35·4224	....	....	....
2	48·7623	....	....	....	2	30·8643	....	....	....
1	48·7182	·7272	·0368	39·94	1	30·7867	·7907	·0849	80·64
3	45·2623	....	....	....	1	27·3707	·3691	·0434	−37·67
1	45·1842	·1967	·0420	43·84	2	27·2482	....	....	....
1	44·1888	·2018	·0574	59·29					

Weighted mean		− 47·30
V_a	+ 7·87	
V_d		− ·09
Curvature		− ·28
Radial velocity.............		− 39·8

δ AQUILÆ 1650.

1908. June 27.
G. M. T. 18h 09m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8350	....	....	....	1	40·5070	·4860	·0400	39·68
2	57·8130	·7880	·0388	−46·71	2	39·7571	....	....	....
2	57·8512	....	....	....	1½	39·6936	·6736	·0532	52·34
1	56·9804	·9559	·0096	11·40	1	38·7283	·7123	·0400	48·70
2	56·6977	....	....	....	3	37·9723	....	....	....
1	55·1051	·0841	·0411	47·92	1	37·2502	·2362	·0526	50·44
2	54·7645	....	....	....	1	36·4397	·4257	·0715	67·28
1½	53·9517	·9337	·0361	41·55	2	35·4463	....	....	....
3	53·1253	....	....	....	2	30·9004	....	....	....
1	51·6990	·6860	·0715	80·22	1½	30·8548	8248	·0508	45·70
½	49·3733	·3583	·0091	10·21	1	27·3920	·3600	·0526	45·65
2	48·7901	....	....	....	2	27·2785	....	....	....
1	48·7440	·7270	·0370	40 14	½	24·8214	·7912	·0554	46·86
2	45·2955	....	....	....	1	24·1079	·0789	·0543	45·12
2	45·2045	·1835	·0552	57·62	2	24·8754	....	....	....
1	44·2292	·2077	·0515	53·19	2	22·5904	....	....	....
2	43·5514	....	....	....	1	22·5118	·4782	·0786	65·08
2	42·1240	....	....	....	1	18·8332	·7823	·0609	−48·65
1	41·2768	·2558	·0414	41·40	2	18·8943	....	....	....
½	40·7092	·6882	·0610	60·79					

Weighted mean............		− 48·20
V_a	+ 7·54	
V_d		− ·04
Curvature		− ·28
Radial velocity.....		− 41·0

δ AQUILÆ 1660.

1908. June 27.
G. M. T. 18^h 09^m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8256				2	45·2745			
1	57·7919	·7829	·0070	− 8.42	1½	45·2107	·2097	·0290	30·27
2	57·8327				1	44·2220	·2215	·0377	38·94
½	56·9519	·9499	·0206	24.55	1	41·7726	·7741	·0575	57·84
2	56·6750				2	41·2848			
2	54·7459				2	41·2964			
1	53·9418	·9398	·0300	34·53	1	39·0028	·9838	·0325	31·75
1	53·7200	·7215	·0360	40·39	2	37·9669			
1	48·7544	·7579	·0079	8·57	1	37·2796	·2726	·0162	−15·53
2	48·7663				2	35·4331			

Weighted mean		−29·35
V_a	+ 7·66	
V_d	·00	
Curvature		− ·28
Radial velocity		− 21·9

δ AQUILÆ 1678.

1908. July 8.
G. M. T. 18^h 10^m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8005				2	43·5657			
½	58·9967	·0037	·0370	−45·21	2	41·8142	·7845	·0471	47·38
½	58·5482	·5552	·0427	51·88	2	41·3185			
1	57·7767	·7837	·0431	51·89	2	37·9962			
2	57·8125				1½	37·7667	·7297	·0250	24·10
1	56·9345	.9415	·0240	28·60	1½	37·2799	·2429	·0459	44·01
2	56·6620				2	35·4685			
1	53·9232	·9322	·0376	43·27	2	30·9250			
2	53·1017				1	30·8610	·8064	·0692	62·14
2	53·1317				1	27·4311	·3611	·0515	44·70
1	51·7239	·7039	·0536	60·13	2	27·3166			
1	48·7590	·7370	·0270	29·29	2	24·9101			
2	48·7919				1½	24·8730	·8080	·0372	31·50
1	47·4680	·4434	·0270	28·89	2	22·6292			
2	45·3027				1½	22·5788	·5063	·0505	41·81
1½	45·2398	·2138	·0249	25·99	2	18·9394			
1	44·2427	·2157	·0435	44·93	½	18·9059	·8099	·0335	−26·76

Weighted mean		−38·83
V_a	+ 2·80	
V_d		− ·09
Curvature		− ·28
Radial velocity		− 36·4

δ AQUILÆ 1690.

1908. July 10.
G. M. T. 13h 37m

Observed by } T. H. PARKER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8492				½	45·2276	·2066	·0321	33·51
1	57·8233	·7873	·0395	−47·55	2	44·2779			
2	57·8653				½	44·2522	·2336	·0256	26·44
½	55·1478	·1183	·0069	8·04	2	43·5578			
2	53·9789	·9519	·0179	20·60	1	43·5248	·5053	·0279	28·59
2	54·7702				2	39·7623			
1	53·6528	·6260	·0415	47·60	1	38·7677	·7407	·0116	11·29
2	53·1388				1	37·7768	·7483	·0161	−15·52
1	47·4598	·4377	·0327	34·98	2	37·9904			
2	45·2945								

Weighted mean		−27·41
V_a	+1·71	
V_d		− ·12
Curvature		− ·28
Radial velocity		− 26·1

δ AQUILÆ 1695.

1908. July 11.
G. M. T. 13h 27m

Observed by J. S. PLASKETT.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8527				2	45·3050			
1	59·6739	·6354	·0391	−48·13	½	45·2435	·2215	·0172	17·95
½	59·0715	·0335	·0396	48·39	2	44·2905			
1	57·8545	·8185	·0083	11·19	½	44·2539	·2224	·0368	37·97
2	57·8587				2	42·1319			
½	56·9778	·9428	·0233	27·77	1½	41·8032	·7749	·0567	57·04
2	56·7102				2	39·7632			
1	55·1281	·0941	·0311	36·26	1	38·7665	·7405	·0118	11·49
2	54·7768				2	30·9112			
1	53·9813	·9473	·0225	25·89	½	30·8476	·8146	·0610	54·74
2	53·1442				1	27·4370	·3990	·0136	11·80
1	52·4120	·3790	·0358	40·48	2	27·2825			
1	51·7425	·7085	·0490	54·97	2	18·8835			
2	48·8042				1	18·8525	·8124	·0310	−24·8
1½	47·4810	·4485	·0219	23·43					

Weighted mean		−35·50
V_a	+1·26	
V_d		− ·12
Curvature		− ·28
Radial velocity		−34·6

δ AQUILÆ 1703.

1908. July 13.
G. M. T. 18^h 52^m

Observed by / Measured by } T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8090	....	....	....	2	37·9609	....	....	....
½	57·7842	·7832	·0436	−52·49	1	37·2499	·2469	·0419	40·18
½	56·9494	·9484	0171	20 38	2	30·8904	....	....	....
2	54·7423	....	....	....	1	30·8531	·8331	·0425	38 15
2	45·2766	....	....	....	1	27·4061	·3769	·0357	30·98
½	45·1916	·1896	·0491	51·26	2	27·2758	....	....	....
2	43·5362	....	....	....	2	22·5816	....	....	....
1	43·4567	·4587	·0745	76·36	1	22·5331	·5083	·0485	−39·77

Weighted mean..............		−43·25
V_a..........	+ 0·36	
V_d......		− ·16
Curvature......		− ·28
Radial velocity.....		−43·3

δ AQUILÆ 1753.

1908. July 31.
G. M. T. 16^h 41^m

Observed by / Measured by } T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	30·8945	....	....	....	2	22·5725	....	....	....
1	30·8828	·8588	·0168	−15·08	1	22·5388	·5231	·0387	32·04
½	27·4102	·3822	·0304	26·38	2	18·8774	....	....	....
2	27·2757	....	....	....	1	18·8637	....	·0137	−10·94

Weighted mean................	−22·81
V_a..............	− 7·60
V_d.......	− ·09
Curvature	− ·28
dial velocity......	−30·7

δ AQUILÆ 1754.

1908. July 31. Observed by W. E. HARPER.
G. M. T. 17ʰ 17ᵐ Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7652	....	....	....	2	43·5520	....	....	....
2	53·9794	·9574	·0124	−14·27	2	37·9742	....	....	....
2	53·1334	....	....	....	1	37·2646	·2496	·0402	38·55
2	48·7862	....	....	....	2	30·8961	....	....	....
1	47·4588	·4418	·0286	30·60	1	30·8566	·8346	·0420	37·71
1	45·9683	·9533	·0307	32·29	1	27·4200	·3950	·0176	−15·27
2	45·2930	....	....	....	2	27·2709	....	....	....
1	45·2278	·2128	·0259	27·03					

Weighted mean	−26·25
V_a	− 7·61
V_d	− ·12
Curvature	− ·28
Radial velocity	−34·2

δ AQUILÆ 1754.*

1908. July 31. Observed by W. E. HARPER.
G. M. T. 17ʰ 17ᵐ Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7189	....	....	....	1	45·1899	·2129	·0258	26·93
1	53·9370	·9575	·0123	−14·15	½	44·2025	·2255	·0337	34·81
2	53·0936	....	....	....	2	43·5112	....	....	....
½	52·3557	·3772	·0376	42·52	2	37·9405	....	....	....
2	48·7477	....	....	....	1	37·2294	·2504	·0384	36·82
½	48·6932	·7212	·0428	46·48	½	27·3766	·3883	·0240	−20·84
½	47·4122	·4352	·0352	37·66	2	27·2349	....	....	....
2	45·2530	....	....	....					

Weighted mean	−36·05
V_a	− 7·61
V_d	− ·12
Curvature	− ·28
Radial velocity	−44·0

*Check measurement.

δ AQUILÆ 1768.

1908. Aug. 5.
G. M. T. 18^h 05^m

Observed by J. S. PLASKETT.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8186	....	....	....	1	45·9871	·9876	·0036	+ 3·78
1	57·8102	·8077	·0191	−22·99	2	45·2749	....	....	....
2	57·8271	....	....	....	1	45·2148	·2168	·0219	−22·86
2	54·7437	....	....	....	1	44·2346	·2376	·0216	−22·31
½	53·9784	·9784	·0086	+ 9·89	2	43·5328	....	....	....
2	53·1097	....	....	....	1	41·7874	·7924	·0392	−39·43
½	52·4313	·4303	·0155	+17·53	2	41·2791	....	....	....
2	52·2541	....	....	....	2	30·8758	....	....	....
2	48·7696	....	....	....	½	27·3845	·3779	·0361	−31·33
1	48·7376	·7361	·0279	−30·29	2	27·2532	....	....	....

Weighted mean..................	−19·51
V_a	− 9·77
V_d..................	− ·19
Curvature..................	− ·28
Radial velocity	−29·7

δ AQUILÆ 1783.

1908. Aug. 15.
G. M. T. 17^h 38^m

Observed by J. S. PLASKETT.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8126	....	....	....	2	45·2802	....	....	....
1	57·8193	·8023	·0245	−29·49	1	45·2457	·2404	·0020	+ 2·08
2	54·7335	....	....	....	½	44·2265	·2205	·0387	−39·97
1	53·9473	·9573	·0125	14·38	2	43·5434	....	....	....
2	53·0995	....	....	....	1	41·3061	·2951	·0021	2·10
½	52·4002	·4072	·0076	8·58	½	40·5358	·5258	·0021	2·08
2	52·2469	....	....	....	2	37·9743	....	....	....
½	51·7060	·7120	·0455	51·05	1	37·2659	·2499	·0389	37·30
1	49·3467	·3487	·0213	23·25	2	30·9025	....	....	....
1	48·7663	....	....	....	1	29·8983	·8643	·0105	9·31
½	48·7345	·7360	·0280	−30·38	½	27·4506	·4116	·0010	− 0·86
1	47·4838	·4828	·0124	+13·26	2	27·2858	....	....	....
½	45·9813	·9773	·0073	− 7·67					

Weighted mean..................	−14·85
V_a	−13·84
V_d..................	− ·22
Curvature..................	− ·28
Radial velocity..................	−29·2

δ AQUILÆ 1837.

1908. Aug. 27.
G. M. T. 15^h 03^m

Observed by J. B. CANNON.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0183	....	....	....	2	45·2880	....	....	....
½	72·8513	·8430	·0218	−31·63	1	45·2372	·2232	·0155	−16·18
2	72·4532	....	....	....	1	44·2399	·2264	·0328	−33·91
2	59·8129	....	....	....	2	43·5517	....	....	....
1	57·8288	·8283	·0015	+ 1·80	1	41·8079	·7949	·0367	−36·92
2	54·7500	....	....	....	1	37·9771	....	....	....
1	53·9747	·9667	·0031	− 3·56	1	37·3070	·2925	·0037	+ 3·54
2	53·1197	....	....	....	2	30·9079	....	....	....
½	51·7273	·7173	·0402	−45·10	½	30·8756	·8386	·0370	−33·22
2	48·7819	....	....	....	1	30·4141	·3751	·0375	−32·55
1	47·4976	·4846	·0142	+15·19	2	30·2857	....	....	....
½	46·0043	·9915	·0041	+ 4·31					

Weighted mean	−20·95
V_a	−18·18
V_d	− ·09
Curvature	− ·28
Radial velocity	−39·5